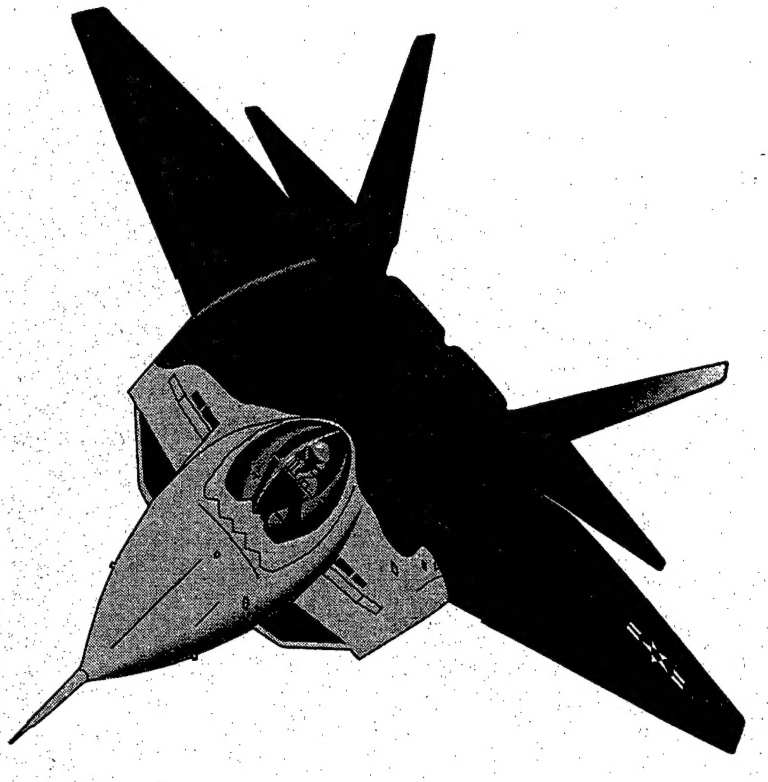
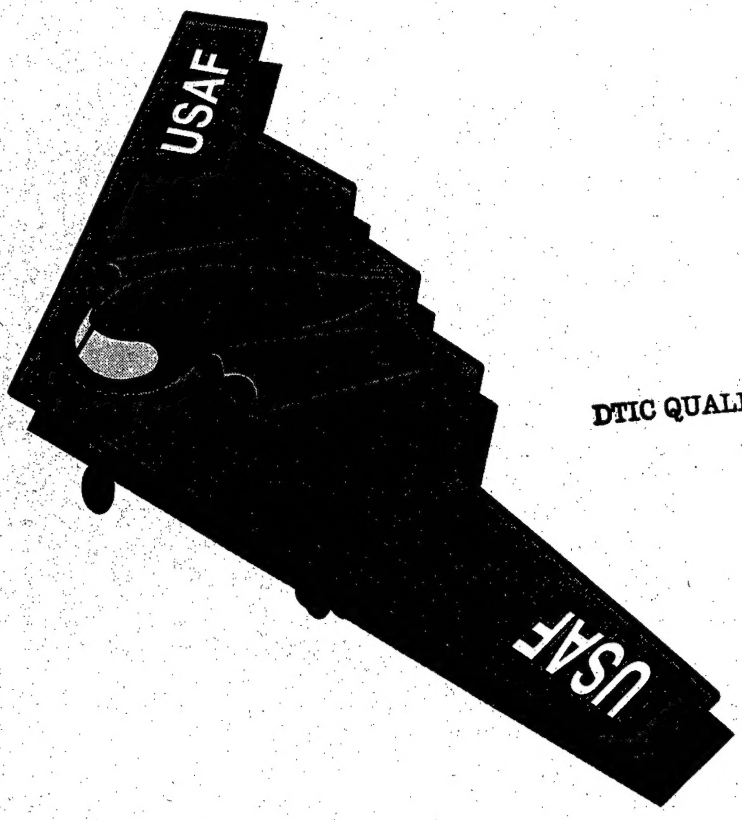
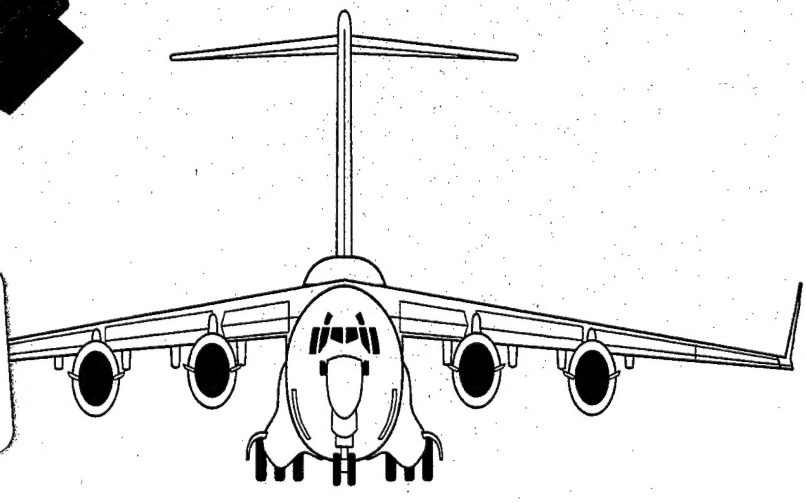


A Reengineered Weapons Acquisition Process

Published by the Aerospace Education Foundation





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Aerospace Education Foundation

A Reengineered Defense Industrial Base

Partial Proceedings
Reengineering the Defense Industrial Base Symposium
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Reengineering the Defense Industrial Base

General Ronald W. Yates
Commander, AFMC

Thank you, Monroe. Well, I'm happy that you're all here in Dayton with us today. Let me thank the Air Force Association for once again helping us provide a very valuable forum to discuss some very important issues that are confronting all of us who are members of the defense industrial base.

Our goal for this second annual national-level symposium is to help both the Air Force and industry better understand where we're going and allow us to share our perspectives and concerns on acquisition and logistics issues.

Last year, marketing and sales expert John Graham predicted that, "When the year 2000 rolls around, the nation's corporate landscape will have changed more in the previous seven years than it did in the 93 years prior to that."

Perhaps no other segment of corporate America is going to prove that more than our segment, the defense industrial base. And that's why we're focusing on "Reengineering the Defense Industrial Base" in this symposium.

The term reengineering is described as a drastic step and something that no organization should undertake lightly. I recently heard about a neurosurgeon who was having problems with his sink, so he called in a plumber. The plumber took apart the trap, and he ran his snake through the pipe and he got the sink working again. He worked on this about two hours, and when he finished, he gave this neurosurgeon a bill for $400. The neurosurgeon looked at the bill and said, "$400! For two hours? That's $200 an hour. I'm a neurosurgeon and I only get about $150 an hour." The plumber said, "Yeah, $150 an hour, that's about what I got when I was a neurosurgeon too."

Now, there is a guy who reengineered his career. We're talking about that level of pain in reengineering our companies.

That's to say by 1996 or 1997, we may be looking at a defense market about one-third of what it was 10 years ago.

I'm not going to give you all these statistics about what's happened to our industry. You know those as well as I do. This is the 9th straight year the defense budget has declined. But, I think Secretary Perry [Dr. William J. Perry, Secretary of Defense] said something recently that really puts it in perspective for us. He made the point that the procurement budget is down about 50 percent since 1986. And, he said "We estimate it will go down by as much as a total of 65 percent by the mid-1990s. That's to say, by 1996 or 1997, we may be looking at a defense market about one-third of what it was 10 years ago."

If we just look at aircraft, in 1985 all the services combined were buying about 900 combat aircraft. This year, the Department of Defense is budgeting for 127 combat aircraft, and almost half of those are utility helicopters. So if we look strictly at fixed wing combat aircraft buys, and divide them by the number of prime contractors, that equates to us buying less than 10 aircraft per year, per prime contractor.

In recent congressional testimony, Secretary Perry reaffirmed DoD's policy of letting the marketplace work in downsizing defense. And, there are studies that show that up to 80 of the top 100 defense companies could

conceivably disappear by the end of this decade. As a result, it is possible that we may be left with only two or three producers of military aircraft by the turn of the century. Already, the aerospace segment of the defense industry has lost, depending on how you count them, almost half a million jobs.

Reengineering is defined as 'process innovation and core process redesign....the search for and implementation of radical changes in business procedures to achieve breakthrough results.'

Norm Augustine [CEO, Martin Marietta] recently wrote: "Today the aerospace industry is about two-thirds over capacity in terms of facilities. It also appears likely that we'll need to lose another 30 to 40 percent of the current employment base in the industry. Hence, the choice is between taking difficult steps today to preserve a core company in the future or simply riding along today and seeing the entire organization become non-competitive and non-survivable a few years downstream."

Changes of the magnitude that we're talking about remind me of what Winston Churchill said when he got voted out of office in 1945.

His wife was trying to console him and she said, "Well, this could really be a blessing in disguise." And he said, "At this time, madam, I'm more conscious of the disguise than the blessing."

We're wearing the disguise right now. Our blessing may be that reengineering offers us the opportunity to reshape the defense industrial base to a more vital and competitive industry in the next century. But this is not a quick fix, it is strong medicine. It is not about tweaking old procedures; it is not about tweaking business enhancement, business improvement or business modification. Nor is it a euphemism for downsizing or reorganizing. It is not designed to replace other initiatives such as Total Quality. In fact, I contend that you can't reengineer without the Total Quality environment of empowerment because that empowerment is where we generate truly creative ideas. You must have an organizational willingness to change. That again comes from a TQ environment as well as plenty of practice at changing before you can step up to this reengineering effort.

Reengineering is defined as "process innovation and core process redesign....the search for and implementation of radical changes in business procedures to achieve breakthrough results."

The concept of radical breakthrough, in my view, is further complemented by the Total Quality philosophies of measurement and continuous improvement. Because if you do a radical breakthrough change in your company or your organization, you aren't going to get it right the first time. You are going to have to track it with metrics and you're going to have to continuously improve in order to make it work.

Reengineering is really nothing short of reinventing our organizations. And it is not something that should be undertaken lightly. As Thomas Stewart, who was writing in Fortune magazine, said recently, "It ain't easy and it ain't cheap. It's almost always accompanied by pain and the most important lesson from business with reengineering is don't do it if you don't have to."

Reengineering means starting over from scratch. It means figuring out why we do what we do and why we do it the way we do it. It means asking ourselves, "if we were a new company, what business would we be in and how would we do business?"

But, considering the choices that the defense industrial base faces, there can be little question that this is something that we have to do. According to the experts, the prime can-

didates for reengineering are organizations faced with a dramatically altered competitive landscape, particularly those facing the alternative of changing how they do business or closing their doors and going out of business. That's a very apt description of our industry.

Reengineering means starting over from scratch. It means figuring out why we do what we do and why we do it the way we do it. It means asking ourselves: "If we were a new company, what business would we be in and how would we do business?" For the aerospace world in particular, many of the old rules no longer apply. After all, if we ask ourselves these tough questions, how many aerospace companies today would go out and design their organizations for a Cold War defense buildup? How many would organize themselves to be prime manufacturers of fighter aircraft? Some would, I hope, but not as many as we had.

We need to discard the old rules and fundamental business assumptions that no longer apply. Unless we change those rules and assumptions, any superficial reorganization will be no more effective than dusting the furniture at Pompeii.

The most fundamental factor in reengineering is focusing on our customers. Focusing on our customers determines our product, followed by devising processes to best deliver the product our customers want. The drastic geopolitical changes that resulted from the end of the Cold War combined with severe budget cutbacks forced us to reengineer how we do Air Force acquisition and logistics. Jim [McCoy] was just referring to that in the introduction.

In forming Air Force Materiel Command, we basically reengineered the old Air Force Systems Command and Air Force Logistics Command into a new command. We didn't just reorganize it, we reengineered it. In doing this we were guided by what our primary customers, the warfighters, wanted. What do they want today? What they want today is dramatically lower costs. That is one of the fundamental changes that is sweeping through the defense world today.

During the Cold War, we almost always wanted to deliver performance and schedule. Now the single most important driving factor is efficiency. Gary Denman, who's now head of the Defense Advanced Research Project Agency, said recently: "The affordability of military systems will ultimately be one of the defining factors that determines the future force structure. A few years ago our focus was almost exclusively on advanced capability. Today, our focus is heavily on affordability."

Science and technology are our forte. We have always used them for great performance. We need to turn that talent toward producing lower cost systems. We've got to learn to produce at lower rates. We've been talking about this for years. My observation on the way we've always done business is that we must be brilliant because when we decide on the initial production rate it is absolutely the "perfect rate." Absolutely perfect, and I can prove that it is perfect. Because if you increase the rate, it is more expensive. If you decrease the rate, it is more expensive. So whatever we decided to begin with had to be the "perfect rate." We've got to start picking "perfect rates" that are a lot lower than any of us have dealt with before.

And we really can't lower our costs without a radically different relationship between our primes and subs. We need to establish long term relationships that will encourage the stability necessary for low rate production.

In addition, we have to invent a way to deal with fluctuating budgets. This is an often-cursed affliction. But as much as any other phenomenon, it is a fundamental characteristic of the defense business. If you sat down and tried to describe the business world we are in, you would have to write down fluctuating budgets. And, I don't see any of that changing. In fact, I not only don't see it changing, I don't see it getting any better.

So somehow we must figure out how to do this. We need to reengineer with a focus on dealing with budget fluctuations efficiently. Those people who do that have a chance of being profitable in the future. This means that many companies will have to take a hard look at their processes and determine what adds the most value, and overhaul those that aren't as efficient.

But, overhauling processes often dictates a change in organizational structure. Many

traditional organizations are structured along functional lines. We have talked about that here in AFMC at a conference in Dayton. The traditional focus was on tasks, jobs, people or structures, but not on processes. One of the best ways of focusing on processes is by using cross-functional, multi-disciplinary teams in an integrated product development.

It is a cornerstone of the way we do business in Air Force Materiel Command. You are a vital part of what we do. In some cases, we are contractually directing you to form yourself into integrated process teams. It is the wave of the future. The faster you can move yourself and your company in that direction, the better off we will all be.

The traditional focus was on tasks, jobs, people or structures, but not on processes. One of the best ways of focusing on processes is by using cross-functional, multi-disciplinary teams in an integrated product development. It is a cornerstone of the way we do business in Air Force Materiel Command.

Lawrence Bossidy of Allied Signal said, "We used to manage by means of hierarchical, vertical layers. Now, we are solving problems and revamping processes through horizontal, cross-functional teams composed of employees from different disciplines and reporting relationships."

Northrop's B-2 division has organized into integrated product teams, particularly in manufacturing, assembly and test, and has added considerably to their efficiency at the Palmdale facility.

The F-119 Engine Program at United Technologies' Pratt-Whitney Plant in West Palm Beach has fully aligned into IPTs which they formed as part of their initial management approach in bidding for and winning the F-22.

Independent consultants have found that 90 percent of our process improvements have been achieved by having contractors convert from strong, functional alignments to strong IPTs. However, even though Air Force people are important parts of these teams, simple manning constraints keep us from populating the contractor's IPTs with sufficient numbers of people for a continuous presence.

We don't conceive of being able to do that. However, we know how to implement IPTs. Our view of integrated master plans, integrated master schedules and technical performance measures, means that we sign up to the program process at the accountable level. Everyone has a piece of the program.

We don't have to see each other every day. Video teleconferencing has proven to be a very productive process for keeping us glued together.

Let me mention another factor that's been on our minds a lot in terms of reengineering and keeping the industrial base strong — prime contractors looking to mod and repair work to help make up for business lost to cuts in our procurement budgets. You've heard me talk about this before. I'm not going to belabor the point, but most prime contractors aren't organized to be competitive in the mod and repair business. The fact that I am not going to compete in that business does not change that equation. They're still not organized to be competitive with other mod and repair companies in the commercial industrial base.

So, if the primes are going to be competitive, they are going to have to reengineer and become more like mod and repair houses. The primes will never be competitive carrying the overhead of design teams or technical services and labs.

The same principle holds true across the whole spectrum of our business. It is conceivable that a corporation could be competitive at all phases of the aerospace market, including design teams, mod and repair, engineering and technical services, but to do this would require reengineering and segmentation into mod companies, technical support companies, and a core, full service design company with the ability to draw on all segments if you have a new corporate objective or a new major program.

That is something that some companies have already started, but that all are going to have to face. Whatever strategy corporations pursue to meet the challenges affecting their business, we in the Air Force have an interest in the outcome.

Even though the defense market has changed drastically, one thing remains constant — we will always need healthy, viable and competitive partners in industry to maintain the overall health of our defense industrial base. That's why reengineering is so important.

I recently heard about three baseball umpires who were comparing notes on their profession. The first one said, "There are balls and there are strikes. And we call them as they are." The second one disagreed slightly. He said, "There are balls and there are strikes and we call them as we see them." The third umpire said, "Hey, you're both wrong. There are balls and there are strikes, but they ain't nothing until we call them."

If we're going to call our future in the defense industrial base, we're going to have to face reengineering, and for sure, we're going to have to cooperate together. Working together we can successfully make the transition so we can continue providing the aerospace power our nation needs to meet the challenges of an uncertain world.

Thank you very much and I'm looking forward to your questions.

Integrated Weapon System Management

Panel:

Maj. Gen. Roy D. Bridges, Jr.
Director, Requirements, AFMC
Colonel William D. Rutley
F-15 SPD, WR-ALC
Dr. Robert "Bart" Barthelemy
PGM Training Systems, ASC
Lt. Col. Joseph P. Bisognano
PGM, Communications Systems, ESC

***GENERAL HATCH:** Next we will address Integrated Weapon System Management (IWSM), the new approach to weapons system acquisition and logistics. This approach certainly does reflect a major change in how the Air Force does business. A single manager is responsible for the weapons system from its development to its maintenance and logistics support and its upgrades into retirement. We have with us four distinguished speakers. Leading off the panel will be Air Force Materiel Command's Director of Requirements, Major General Roy D. Bridges, Jr. He will be followed by Dr. Bart Barthelemy, a name familiar to many of you from his earlier duties with the national aerospace plane, and he is now the Director of the Training Systems Product Group. He will be followed by the Director of the F-15 System Program Office, Colonel Bill Rutley, and then we will hear from the Director of the Communications Product Group, Lieutenant Colonel Joe Bisognano. Each of these gentlemen will give remarks about their areas of responsibility, the successes that they've achieved and the challenges that lie ahead. After their presentations, we will have a question and answer period. At this time, please help me welcome Maj. Gen. Roy Bridges.*

MAJ. GEN. BRIDGES: Thank you General Hatch and let me start by saying thank you for coming back from the break to listen to our session this afternoon. Why are we even talking about IWSM today? Especially, since we've been working on it since 1991. Well, it is the foundation of our command and it represents a framework for change in the command. It is about cultural change, and cultural change is tough. If you don't believe that, you've never been married. You have heard before that IWSM was the unifying philosophy for the merger between the Air Force Logistics Command and the Air Force Systems Command. That was a marriage of sorts and we needed something to help us improve our business practices as we brought these two commands under one roof.

I'm going to briefly provide a definition for IWSM; talk to you about the philosophy — the eight tenets of IWSM — and give you a status summary on where we are in implementing this across the command. Then my distinguished panelists will talk to you about the real life of IWSM within three specific programs.

This is the definition of IWSM. It is encompassing. It is a philosophy; it is not an organization; and it is not a cookie cutter approach.

It empowers one person, the single manager, with authority over the widest range of decisions. From that respect it is visionary. We have had to accept the best we could get today in terms of how much empowerment we can give our single managers. In many respects, we are working with Mrs. Preston and other people in the Administration to increase the flexibility and authority of the single managers to help them make better decisions as we buy our weapons systems.

Key IWSM Positions

- SINGLE MANAGERS (SM)
  - System Program Director (SPD)
  - Product Group Manager (PGM)
  - Materiel Group Manager (MGM)
- KEY PERSONNEL SUPPORTING SM
  - Development System Manager (DSM)
    - Manages Development Efforts at PC
    - SM Located at a Different Center
  - System Support Manager (SSM)
    - Manages Sustainment Activity at ALC
    - SM Located at a Different Center
- ONE MANAGER - ONE PROGRAM
  - Applies to Single Managers, DSMs and SSMs

We have three kinds of single managers, two of them represented on the stage today. We have System Program Directors (SPDs) with authority for buying complete systems, such as the F-15 which Colonel Rutley will talk about.

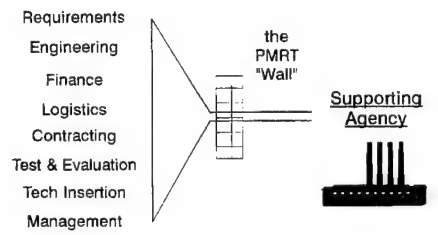
We have Product Group Managers (PGMs) who are providing systems to both system program directors as well as other external customers. For example, we have training systems, which Dr. Barthelemy will talk about, or communications systems, which Joe Bisognano will talk about. We also have Materiel Group Managers (MGMs) who deliver what we used to call commodities. These are things like landing gear sustainment for all the weapons systems in the Air Force or fuels or support equipment. An IWSM organization has a single manager, and if he is located at an Air Logistics Center and has development still going on in his program, he will have a development system manager located at a product center who will report to him. If early in the life cycle of a program and the single manager is located at a product center, then he will have a systems support manager located an Air Logistics Center who is responsible for sustainment aspects of the program.

As a program moves through the life cycle, the responsibility never transfers from the single manager. He may move locations as the center of gravity shifts from development to sustainment. But, throughout the life of the system, there is one manager for one program. We have consolidated programs considerably, but within the consolidated program, there is one manager.

IWSM PHILOSOPHY

We developed the IWSM philosophy around eight tenets. I'm not going to talk to you about all of them today as many of them are fairly self-explanatory. They are all very important and they are interlinked. One of them — the eighth one, Integrated Product Development — was discovered as we went through the process of developing IWSM using a clean sheet of paper and a Total Quality approach.

SEAMLESS PROCESSES



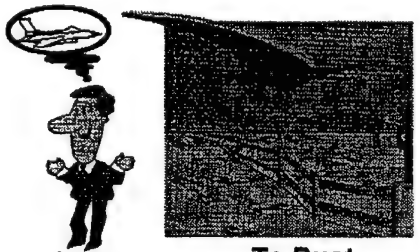
When we started IWSM back in 1991 after the announcement of the merger of the

two commands, we had a situation where we literally established a wall between the acquisition agency and the supporting agency as the system progressed through the life cycle. That wall was called the "transfer of program management responsibility." In many cases, single managers on each side of the wall were sub-optimizing decisions for a particular life-phase of the program.

To do IWSM, we wanted to use a Total Quality approach. So, we started by recognizing the eight processes that we used in both the acquiring and the supporting agency throughout the life of a system. We then had the eight process owners to look across 21 prototype charter programs for IWSM. They organized themselves using their very best ideas from the grass-roots level. After talking to both sides of the organization, the process owners found the best practices that were in use across both commands. We documented those best practices in our IWSM guide and then in our Air Force acquisition model which is a computerized aid to help remember and learn the principles. All the other 106 programs used these best practices to define how they would run their programs.

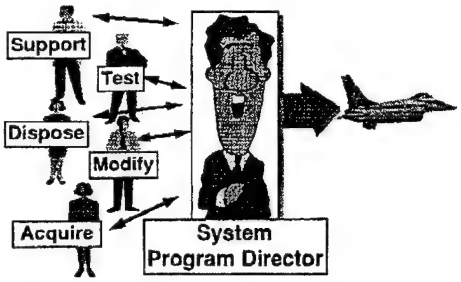
We improved the efficiency of this process significantly because we used to have a lot of "seam" organizations to translate issues from one side of this "seam" or "wall" to the other side. We did away with all those "seam" organizations.

CRADLE TO GRAVE



Another critical tenet of IWSM is that the single manager is now responsible for the system from cradle-to-grave. He now tends to look at each one of his decisions a little differently than he did before. I think we are getting a lot better decisions for the Air Force.

SINGLE FACE TO THE CUSTOMER



Finally, we had a very complicated process, where we had a different face depending on where the system was in the life cycle. Some parts had transferred, some parts had not transferred. You practically had to know the serial number of an airplane and look it up in the book to figure out who to go to if you had a problem. We have done away with that. Now all the decisions are made with one single face to the customer and the customer's voice is in everything that we do.

Summary

- Progress to Date:
  - 800+ Programs → 106
  - Full Operational Capability: 92
- IWSM is the KEY
  - Framework for Cultural Change
  - Enhanced Customer Satisfaction

In summary, let me give you a progress update. After the new command stood up and we had completed our process on the 21 charter programs, we began a complete multi-step process to go through and implement IWSM on all 106 programs. This is a reduction from 800 plus programs with which we started. We reached initial operational capability in June of 1993 and full operational capability on 92 of those programs this past March.

IWSM is a key for cultural change throughout the command. We have a long way to go. We are not finished because full operational capabilities simply means that the program is up and running using IWSM tenets. It doesn't mean that they are really fully optimized.

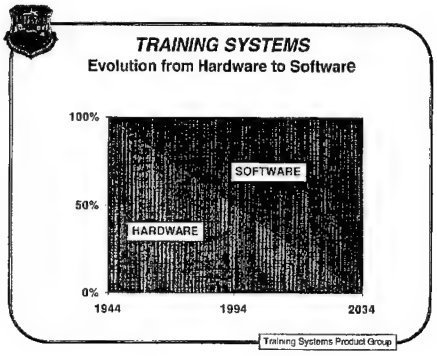
A key to integrated product development is enhanced customer satisfaction which is that eighth tenet of IWSM. You'll understand

more about the importance of IPD tomorrow when Major General (select) Bob Raggio, the F-22 System Program Manager, talks to you about IPD along with his industry partner, Mr. Gary Riley, Vice President and General Manager for the F-22 at Lockheed. Thank you.

Dr. Robert "Bart" Barthelemy: You must be depressed after seven hours of discussion on reengineering, downsizing, reform, consolidation and 65 percent cuts. So, I'm here to give you some good news. The training area is blossoming. The training systems product group has a budget that is at least flat, if not increasing over the next five to ten years. Technology is just exploding. It is just bombarding us with all kinds of new possibilities and capabilities, and we are looking into the future with a whole new viewpoint than we have had in the past. The concept of IWSM makes so much sense to the training systems product group area that we've jumped into it with great relish and we've made some interesting progress.

Before we discuss IWSM, I want to talk about what the training systems area is all about. I've chosen to do it with organizational charts. The concept of training systems is an expanding situation and one that the Air Force and all of the services are going to be much more dependent upon. This has led us to a certain approach to IWSM that is based on the tenets that were just discussed, but one that is also tailored to our particular situation.

Because of our optimism and positive outlook, we've taken on a very strong vision. This is a national vision that is shared by the entire IWSM team within the Air Force, as well as the entire national industry team. As you can see, it is very optimistic: "Training services that exceed expectations, products that exceed imagination, and simulators that exceed reality." That is what we intend to do. We can't do that with the structure and the system that we have today, but we will be able to do within the context of where we are headed.

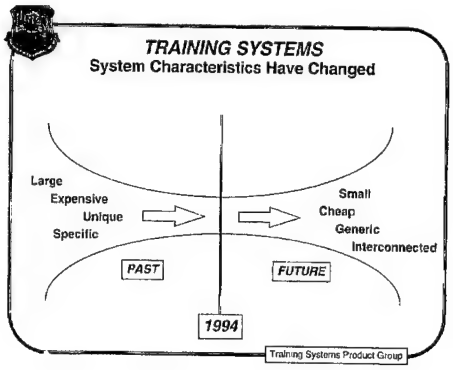


You've probably all seen the Link "blue box." Notionally, I went back to World War II and looked at simulators of that vintage. They were all hardware. The Link Trainer was a little box with some pressure gauges and things like that — no software and no computers as they hadn't been invented yet. It was just a hardware system.

The future prognosis is that hardware is going to go away. We are right about in the middle of the whole situation with 1994 at the 50-50 point. Not that we are spending 50 percent of our money on hardware and 50 percent on software, but today's training systems are transitioning from mostly hardware and a little software to mostly software. Eventually, near the year 2030, training systems will be all software. It will be virtual reality. There won't be cockpits. People will think they are in cockpits. Training will essentially be a total software system. That has a major implication on what we want to do in the Air Force and in the country in terms of training and education. If that is where we are going, we'd better set up organizational structures and systems that deal with that kind of a reality and not embed ourselves in the past on how we move hardware from an acquisition activity to a sustainment activity. That just won't hack it.

Because it is becoming more software intense, the distinction between the software

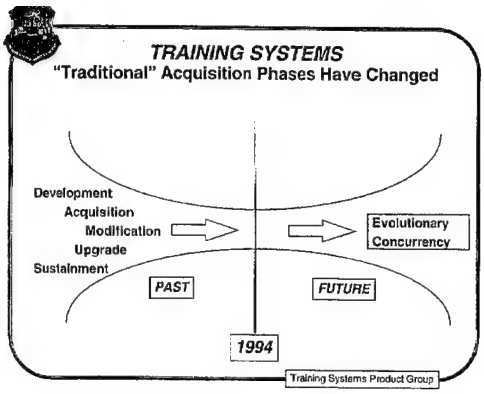
systems is going away. We are also demanding much more from our training systems.



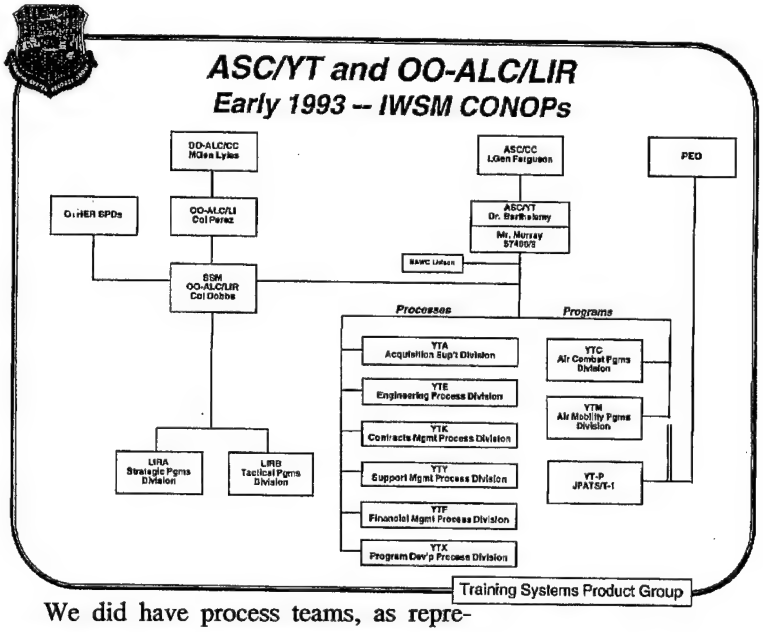
We are also demanding that they be cheaper. We've heard about affordability all day long. We also need them to be interconnected because they Air Force wants their simulators and their training systems to talk to each other since that is how we are going to fight the battles. There is no point in training individually when battles will be fought with a total team effort. We want small and we want cheap. The simulators of $200 million to $500 million are gone. The whole concept of training is changing. We have to construct a system, an IWSM system, that can deal with that major change.

Because it is intensely software oriented, the distinction between acquisition and sustainment — the distinction between modification and keeping things up to speed — is going away. Very shortly, it is going to be gone. We'll have simulators that will live for 20 or 30 years and what will change is the software. So, what used to be an acquisition activity will now be looked at as a sustainment activity. What used to be a sustainment activity may be in acquisition because modifications and upgrades will take the place of the normal way of doing business.

Given that situation in the future, we've done a lot of strategic planning and strategic visioning before we did anything about the organizational structure. What you are about to see occurred in the last nine months because we wanted to react quickly to the IWSM and the IPT thrust.

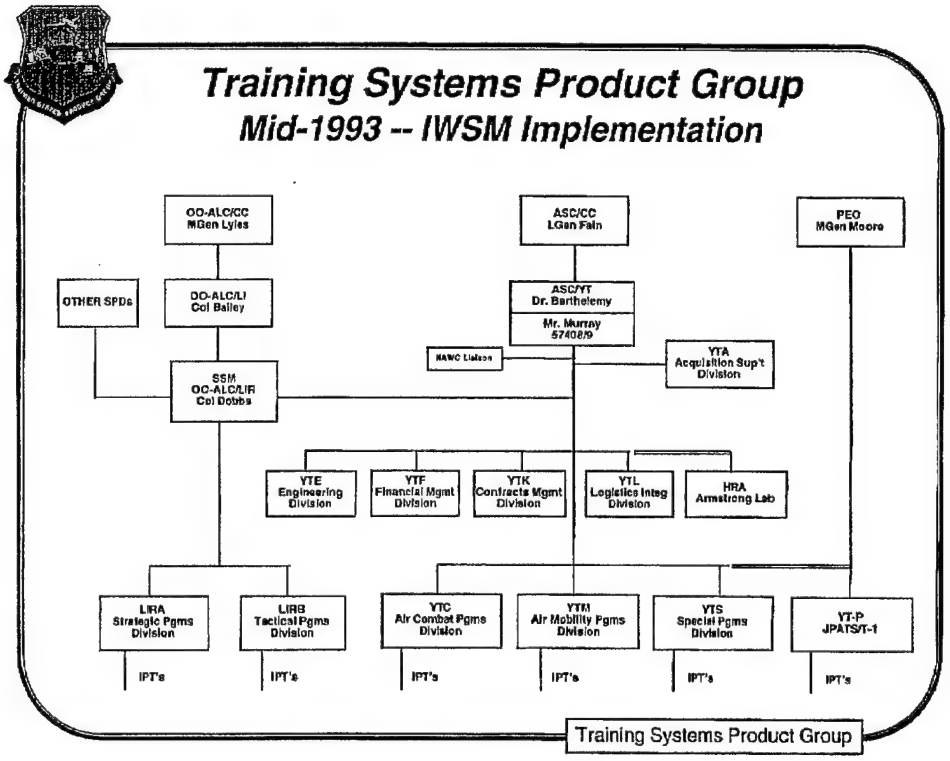


This was our organizational structure when somebody said: "Let's make this an IWSM activity." We first connected Ogden, the sustainment area, with Wright-Patterson, the acquisition side. Next, we looked at each of our organizations, at Ogden and at Wright-Patterson, and realized we had constructed systems that were quite disparate and also weren't really in keeping with the IPD or IPT philosophy.



We did have process teams, as represented by the long boxes on the chart. There was some process activity on the acquisition side, but there was none on the Ogden sustainment side. We were totally incompatible. We drew a line that connected the two and said, "IWSM is alive." But, it really wasn't alive; it was just that we had connected the organizations.

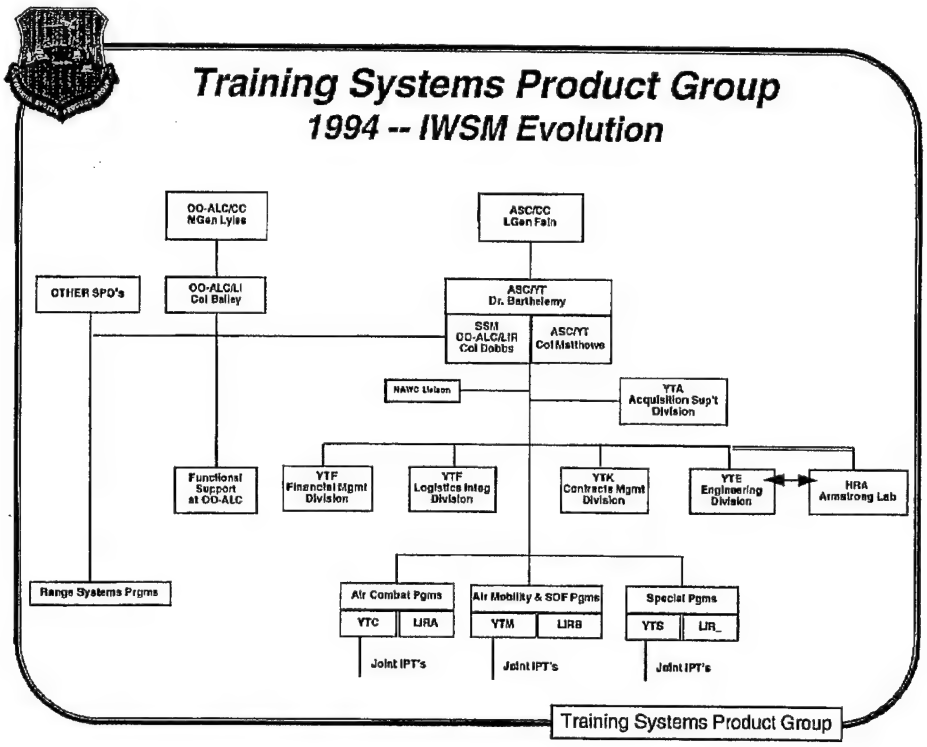
About three months later we said, "Let's get rid of the process teams. Let's form IPTs for all of the weapons systems training systems on both sides of the fence." We formed 40 IPTs, for example we formed one for the F-15, another for the F-16, and one for the C-135.



We had 40 different IPTs, some of which were exclusively at Ogden and some which were managed almost exclusively at Wright-Patterson, but we were beginning to see the common denominator — IPT. Once we found a common denominator, then we could find structures to truly integrate the whole IWSM concept. You are beginning to see the integration of the technology groups, the Armstrong labs and the Wright labs, into the IWSM.

I never think of IWSM as just acquisition and sustainment. It is development, acquisition and sustainment. Since technology is moving so fast, if you forget about the technologists and what they can do for the product business, you've missed it completely. So, IWSM is larger than even what we talked about from an acquisition and sustainment process.

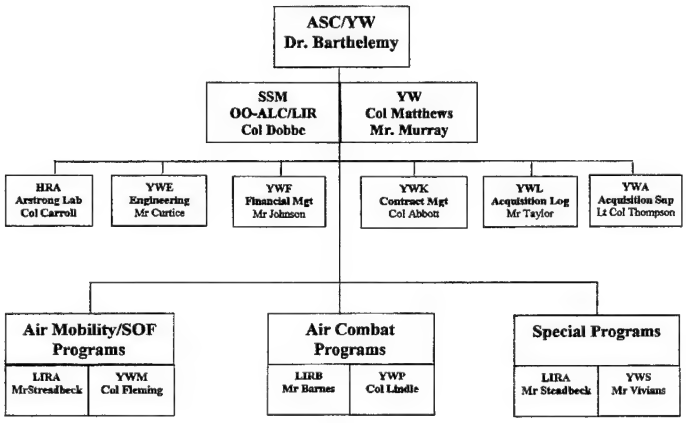
Now, there is a real merging of the two organizations. Even though all of the folks at Ogden still reside at Ogden, and all of the folks at Wright-Patterson still reside permanently at Wright-Patterson, we have set up a structure where there is dual management of the integrated product teams. The chief at Ogden is my deputy and we also have a deputy on the acquisition side. We have a functional structure in the middle of the organization. At the bottom tiers, we have dual management of the major product groups and with combat systems, mobility systems, SOF [Special Operations Forces] systems and special systems, which include AETC [Air Education and Training Command]. All of the IPTs report to two people, one of whom is at Wright-Patterson, and the other is at Ogden. They have to be knowledgeable and they have to make sure that integration is occurring.



Each of the 40 IPTs have people from both Ogden and Wright-Patterson in them. The largest happens to be a SOF IPT, the SOF Training Systems Integrated Product Team, with 20 people from Ogden and 30 people from Wright-Patterson. Those people probably communicate daily, but I know they talk weekly in a video teleconference (VTC). They truly are operating as an integrated team. The head of the IPT is from Wright-Patterson and the deputy is from Ogden. There is a true merging of the two cultures. So, from the superstructure, at the top to the actual IPTs, the IPTs are kings and the rest of us are just there to serve them, including the entire functional group. We've transitioned to an organizational structure and a cultural change that supports IWSM, and that is how we operate.

I just want to mention one other instance of the change. There are very few engineers at Ogden because of a number of factors. Therefore, the engineers at Wright-Patterson support the Ogden activity. We do this through TDYs [temporary duty trips], but will eventually PCS [permanent change of station] them.

Training System Product Group

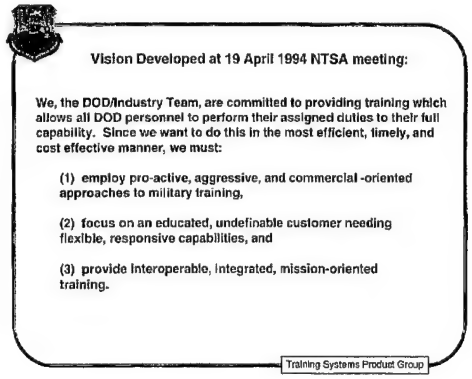


The Ogden contracting activity has come up with some wonderful ways of contracting with industry and we are taking some of the modeling contract and the contract support from Ogden to help our guys at Wright-Patterson. We are trying to make this a homogenous organization.

We operate using a few basic tenets. They are exactly what General Bridges was talking about: seamless operations, one voice to the user, true integrated teams to the point where each has somebody from both sides of the organization. It is still not to the half and half point, and maybe it will never be half and half. Maybe there are things that clearly ought to be predominantly done at one of the centers, either the ALC [Air Logistics Center] or ASC [Aeronautical Systems Center], but we will work that out. It has to be tailored, but the fundamental IWSM culture is now embedded in it.

How deep is this change? Well, it is not all the way down to every single person. We have 500 people in the training systems product group, about 150 folks out at Ogden and 350 at Wright-Patterson. I guess you could ask any one of those people about IWSM, and some people will say, "No, I'm not really comfortable with this." But, we are starting from the top and we are starting from the bottom and we are putting it in the smaller teams. That is one approach to success. If we tried to do it at the 500 person level, it would probably be hopeless.

We are also bringing in industry. I cannot say that industry is part of each IPT except from the standpoint that they are the contractors of the supply and the training systems' products to the IWSM team. But, we just concluded a meeting in Dayton on April 19, using NTSA, the training services association, to help us develop a vision statement with industry. The next step is to bring industrial partners into the IPTs beyond their roles as suppliers and contractors. That is the goal that we both share at both Ogden and at Wright-Patterson.



We've come a long way. We're not 100 percent complete. There are still some cultural differences that probably will always be there, but we are making some great inroads. As we interchange people and interchange functions — I really do think the key is the small IPTs — folks can get together. If you walk into one of their meetings — it might be on a VTC because they are physically in two different places — you really can't tell who is from Ogden and who is from Wright-Patterson. We're feeling pretty optimistic and IWSM is coming along very nicely in the training systems product group. Thank you.

COLONEL RUTLEY: About three or four years ago I was heavily involved with trying to merge the F-16 program office together with the folks out at Ogden and watching the AFLC and AFSC dance that General Yates and General McDonald were trying to orchestrate. I was really concerned whether what we were going through was going to be the right thing to do — not from a paper viewpoint, but from the fact that AFLC and AFSC had their own cultures that had gone on for years, and infrastructures built up over many years. The clash might do more damage than good. I was completely wrong — absolutely 100 percent wrong.

Most of the problems that we have faced in putting the two commands together into what is now Air Force Materiel Command and also instituting IWSM have come about. The cultural clashes were there; the differences were there; the momentum was there; but the results have been quite startling. Even considering that we have a long ways to go, IWSM is critical to the support of the warfighter in the future.

In the F-15 program, the offices were put together by General Childress [Brig. Gen. James Childress] and General Kadish [Brig. Gen. Ron Kadish]. General Childers is now the PEO [Program Executive Officer] for the F-15 program, as well as others. They moved on and turned it over to me and Colonel Destout. Let me introduce you to my other half, Colonel Jim Destout my Deputy Director of Acquistion. You'll see from the two of us that the F-15 has no height requirements so we have true IWSM.

The F-15 IWSM culture is still evolving. It is just under two years old. I relate what we are doing to a two-year-old child because the culture is acting just like a two-year-old child. It is growing; it is learning; it is falling down a lot; making mistakes; whining; balking; and going backward and forward. The best of the two cultures is beginning to emerge, slowly, but surely. There is one team — F-15 A through E models — and all of us are responsible and accountable to the warfighters.

What is also evolving is a virtual team. I know most of us who have done the reading and gone to the various consultants understand what the term "virtual" means. What is evolving based upon the IWSM principles is the "virtual team" organization. We call it the virtual "TEAM EAGLE." At the smallest level, where we call ourself SPO-North and SPO-South [System Program Office], Jim has about two hundred people, and I have over a thousand at Warner Robins [ALC, Ga.], that includes the item managers and our production line workers. But, that is not the team. That is one part of the team. Beyond that are the program PGMs and MGMs, and others who work all these various programs that interface with the F-15 program. They join us in a number of forums as we try to work the F-15 as a team.

It involves the laboratory structure. We're involved in the TPIPT [Technology Planning Integrated Product Team] process and making sure that the technologies that are needed to support the warfighters are indeed ready and transitioned through the SPO as a team. At the product centers, the team includes all the munitions program managers that who are out there and critical to the F-15 weapons system to do its job.

It involves the human systems labs — the life support operations. Our three test centers are all heavily involved as teammates with the F-15 program. Our contractor teammates — from our prime contractor McDonnell Douglas through all the tiers of suppliers and subcontractors — are all on board as trusted team members.

Finally, it involves our AFMC headquarters, our Air Force headquarters, our Secretary of the Air Force, our PEMs [Program Element Monitor] and finally our PEO for whom we work. All are part of the virtual TEAM EAGLE, a single team for the warfighters. It is a tremendous challenge to bring all those people together. There are groups like DSAA, and other folks such as SAF/IA that work with us day-to-day. The challenge of the single manager and the challenge of the leadership of the F-15 is to bring all of those groups together, to give cradle-to-grave, seamless support presenting one face to the warfighter. And are we getting there? Is it perfect? No, we are only two years old. It is going to take a lot of time and persistence before we really are a seamless organization, where we act and think like one organization. But, we are getting there. It is happening.

You've heard about IPD and IPTs. We have a similar set up to what you just saw from Dr. Barthelemy. We call them radar, common avionics, weapons, air vehicle, operational flight programs and electronic combat. Those are the czars: they are co-chairs, SPO-North and SPO-South. They have counterparts developing the contractor teams because the contractors are members of these IPTs. We have 60 to 70 IPTs with a program manager assigned, a lead in both SPO-North and SPO-South. Others involved in the IPTs include contractors, laboratory people, other program director representatives, and people from other ALCs.

That helps make the organization a single organization. What makes it work is the baseline process. We have a baseline contract with the group IPTs and every individual IPT. That baseline contract is our empowerment tool. At the senior leadership level of the program, we have agreed upon cost, schedule and performance issues. In some cases our baselines are signed by other product group

managers or material group managers. These people are now empowered to make it happen. They have a simple, easy computerized reporting system to tell us every month where they stand with relationship to their baseline. Through this system, the program managers communicate if they need management help or do not need management help. If they sought help, where did they seek it from and did they get it?

We use that system and it is very, very powerful. It is also a little frightening for some of these folks. It is the first time they've been handed the stick and said, "OK, this is what you said you needed to do and what you were going to go do, the users agree, the warfighter agrees, go get it done." So that is working.

We have many forums that we use to foster teamwork and empowerment and ownership between us and the warfighters and to provide corporate heading checks. We have executive program manager reviews. We have subsystem reviews. We have sustainability reviews and budget POM [Program Objective Memorandum] reviews. Some of those, the ones I just mentioned, are all now going to be done at the same time in one week, three times a year, and our customer, the warfighter, is there with us every step of the way. In addition, our contractor teammates and PGMs and MGMs are present, so we are all together for a relatively short period of time to make sure we have a heading check on where we are going.

We have a business investment board. We don't spend a single nickel on this program in terms of tactical execution without the warfighter agreeing and concurring with what we are doing. We spend a couple of days working with wing commanders and what their key issues are and whether we are making the right decisions and heading in the right direction. Of course, we have lots of other forums like this that we use in combinations throughout the year to constantly cycle through and make sure we are doing the right things.

Education and training are absolutely critical for our folks, and Jim and I are still working on this. We are not satisfied with where we are going with that. We need to do more. We've done TQM [Total Quality Management] training, and we continue to do that. We've used "theory of constraints" to great effect. We continue to do integrated weapons system management training. We do integrated product team training. We are using Dr. Steven Covey's courses to help our folks learn how to operate in a new environment. We use off-site design shops, and we have a reading program. And there is going to be more to come, all aimed at making sure that IWSM becomes a permanent cultural.

What are some of the successes? We have a master plan — an absolute integrated living master plan — and most of our people understand what is going on, and it is getting better every day. We are working so all 1,300 people understand at least the basics of what the integrated master plan does. We have an integrated product team baseline process. It is not perfect, but it is a true system of empowerment and it is really happening.

Trust is going up in the team and fear is coming down. When you get those two things working that way, the barriers fall away and communications and expectations work really well.

Our warfighter feedback is outstanding. We have multiple feedback methods and all that is working very well. I think they are getting more and more comfortable that they are speaking to an integrated team. As an integrated team, we've worked with the F-16 to come up with post production support. What do you do when you are no longer in production? You have to sustain the weapon system for many years. We are working together with the F-22 and F-16 on a daily basis in weapons integration, symbology, technology and a number of other ways that is really exciting, at least as far as I am concerned. All of us are happy with that.

Our financial budget process has coherence to it, and it is tied to an execution contracting strategy that we review constantly. We are focusing on the F-15A through E together. No longer is it just the E models up at SPO-North and the A-D models at SPO-South. Now, all of the models are worked everywhere by the entire team.

Our programmed depot maintenance is something that I am very excited about. This is a group of 700 folks that were under the gun

a couple of years ago. Now, the last 115 jets have come out on time to the customer, in fact, under time. The last jet we put out for the warfighter was completed in half the time that was promised. That is pretty good. The cost per hour has come down. The number of flow-days has come down. The quality has stayed high. In fact, we have seen no major reportable defects whatsoever in the last two years. So we are returning quality to the customer. That produces warfighting capability on the ramp instead a target sitting somewhere at Warner Robins.

Our focus is on the warfighter. We have hotlines, and we have dedicated faxes for them. We have forums where they are involved in every stage of the game, including our off-sites. Team spirit is excellent. The love and passion for the jet is absolutely outstanding. And, when you have that focus — that love and passion for the jet and the warfighters who fly it — then you can do almost anything.

In the future, we will continue to provide the environment that allows the F-15 IWSM TEAM EAGLE culture to continue to mature. We must guide that maturation process through education and training, and we must have continuous improvement. We have flexibility. We are a learning organization. We are innovative. We do care about what we do, and we deliver quality work.

To help that process, we commissioned a study called "Eagle Vision." Along with our contractors and with the warfighter, we have an integrated team that is going to determine what the jet is going to do and have to do for the next 20-25 years. It is possible that the F-15 is going to be flying in 2020 or beyond. That means that there is still going to be a system program office for that long, 20 or 25 years from now, and some of the future crews flying the airplanes have not yet been born. So, we have quite a task ahead of us to make sure that we have a sustainable airplane out that far.

What is the bottom line? It is our people. As a group, you have talked about the importance of "vision." I completely agree with you. Vision really does count. But, what we talk about everyday is that the people of TEAM EAGLE strive each day to provide the men and women who fly, maintain and supply the F-15 in the field, the highest quality jet at the lowest possible cost. That is what we do for a living. Thank you.

LT. COL. BISOGNANO: Like Dr. Barthelemy, I also have some good news. This is the last briefing of the day.

Let me just say up front that I am really happy to be here to discuss the Communications Product Group, and like Colonel Rutley, I am a believer in IWSM. I was not originally, but now, I am.

We are the communications product team. As General Bridges explained to you, we are a product because we cut across a number of different customers and a number of different SPDs. For example, we provide the HAVE-QUICK radio to Colonel Rutley and his F-15 SPD. So, we are a Communications Product Group.

General Bridges also described to you earlier the process of how the command went about consolidating Systems Command and Logistics Command. A couple of years ago I can remember being faced with the task of taking 40 different programs in various stages — from early development to extreme long-term sustainment. We sat in a room with our partners from Sacramento [ALC] and Warner Robins [ALC] trying to figure out where the center of gravity was. We asked: "How are we going to manage this beast? How are we going to create this communications product group? Where is it going to be located? Where is the management lead going to be?"

It wasn't an easy process and as we went through it, we defined IWSM several different ways. At first, we defined IWSM as "mine." Sacramento wanted to keep theirs. ESC wanted to keep theirs, and Warner Robins wanted to keep their programs intact. As we went through subsequent passes, the IWSM concept was a bit illusionary. We were still wondering what we were trying to do. Some people were stubbornly trying to create their pet process or create their group. It was messy, but it wasn't until the third and subsequent passes that we ultimately determined what IWSM actually was, and hopefully, we are very close to what that concept today.

THE BEGINNING

	1st Pass	2nd Pass	3rd Pass
I	It	Illusionary	Integrated
W	Will	Wondering	Weapon
S	Stay	Stubborn	System
M	Mine	Messy	Management

As a result of going through those various passes and making some very difficult decisions, we came to the organization that we have today. We have nine integrated product teams. We have system support managers at both Warner Robins and at Sacramento. We have integrated product team leads for each one of those integrated product teams. We've tried to consolidate the functional expertise at all the different centers into one integrated process and one team. Each integrated product team has membership from each one of the centers. Thus far, that has worked out very well.

COMMUNICATIONS PRODUCT GROUP

	BEFORE IWSM				AFTER IWSM			
	PROGRAMS ACQ	PROGRAMS SUS	PEOPLE	DOLLARS (millions)	PROGRAMS	PEOPLE	DOLLARS (millions)
ESC	10		90	$322.3			
WR-ALC	10		26	119.2	CPG 25	144	$479.9
SM-ALC	10		34	38.4			

This organization represents about 150 people and a budget of about $500 million. We declared full operational capability on 1 July of last year. What are the benefits? What are we really realizing as a result of this organization? What are we doing well as a result of IWSM?

BENEFITS OF IWSM

- Earlier appreciation of sustainment requirements
  - A more significant part of the initial acquisition
- Unified approach to problem solving via IPTs
- Appreciation of a Communications Product vice individual programs
  - Much better customer support
- Consistent approaches to:
  - Contracting
  - Configuration
  - Testing
  - Ozone Depleting Chemicals (ODC)

We jotted down a couple of things for your consumption. First of all, and this is very important, if there is one benefit from this whole IWSM process, it is that we, on the acquisition side, have a much better understanding of the long-term sustainment requirements. When we make a decision today on what is going to happen 10 years down the road, we realize that we are going to have to live with that decision. So, we work a lot harder trying to understand what the reasoning is behind making those decisions up front. That is a very, very important part of this process.

We have a unified approach to the way we solve problems now. It is no longer just an answer from the sustainment side. It is no longer just an answer from an acquisition side when the user has a problem. It is an answer from a product group perspective. When we answer those questions, we hopefully take into account both an acquisition and sustainment side of the coin.

There is an inherent benefit of grouping together programs into a product group. Now, we can talk to our users as a communication product. Whereas before, we may have taken 40 different programs and we talked to our customers about each one of those individual programs as functional stovepipes. Now, we talk to SPDs and wing commanders and talk about communications in general. That is very important. In some cases in the past, we've provided a wing commander with a solution on one side and a problem on the other side. Before we consolidated our group, we didn't appreciate the problems that caused. Now, as a single product group, we speak with one voice.

In addition, we've tried to provide a consistent approach to contracting, to configuration control, to testing and to the problem of ozone depleting chemicals. We've tried to do that across all our programs at all three locations.

Another advantage to the IWSM process is our single face approach to industry. This provides us with more leverage from a management, from a financial and from a resource perspective. It is also good from the standpoint of industry.

BENEFITS OF IWSM (cont)

- Single Face to Industry; more leverage
- Sharing of Core process expertise
  - Engineering
  - Testing
  - Contracting
  - Configuration

SUCCESS STORIES

- New, consolidated PMD
  - One Program Element Monitor (PEM)
  - One dominant program element
- Proactive relationship with Ground Theater Air Control System (GTACS) SPD
- More focused approach to user problems:
  - Liquid crystal displays
  - Supportability of Commercial-Off-The-Shelf (COTS) Items
- Better financial flexibility
- Video teleconferencing

I'll give you an example. At Sacramento and Warner Robins, they had contractors that were the same as we had ESC. But, by focalizing all the work under the single manager concept, we are speaking with one voice to that contractor, and likewise, the contractor is speaking to us with one voice. We think that provides a definite advantage.

We are also sharing the core process expertise. Dr. Barthelemy explained some of the advantages of doing that. We've experienced some advantages through sharing our engineering talent, our testing expertise, our contracting people and our configuration. We've tried to standardize that across all three centers. In some cases, we've sent people TDY.

This is another potential of this IWSM process. We've sent people out to Sacramento, for instance, for 30 days at a time to understand a little bit more about "sustainment." Hopefully, we can cross-flow that back and get some people from Sacramento to come back to ESC and understand a little bit more about the "acquisition" side. We have been able to share that expertise and we've had a couple problems where we've brought that to bear, and it has been very, very effective.

I also wanted to cover some success stories with you. We have a new consolidated PMD, which is incredible. We had this by FOC. We took about 18 individual PMDs, and consolidated them into one communications product group, PMD. We have one program element monitor. We talk to one person at the Air Staff and we have one dominant program element in which our money is programmed.

We also have a more focused approach to user problems. Number one, we had a sustainment problem with a liquid crystal display in some of our airborne radios. Again, this radio was in sustainment. We discussed the problem and put some of our engineering expertise on it back at ESC. We went to the laboratories to get help and we created a team to solve this problem.

One of the biggest issues that we face in the electronics and the communications business is buying commercial off-the-shelf (COTS) equipment and adapting it to the battlefield. One of the biggest issues that we have in buying COTS equipment is the supportability of the equipment. How are we going to support it, both near term and long term? Bringing the sustainment people on board and discussing it in total from a cradle-to-grave approach has given us a much better appreciation in how we are going to do that.

We have better financial flexibility because all our money is now in one program element. That allows us to have flexibility in terms of moving money around, which is a huge advantage of this IWSM process.

Lastly, we use video teleconferencing. I know General Yates talked about that this morning. We've made a point to provide a video teleconference capability for all three of our locations. We meet at least on a weekly basis to discuss various issues.

Where do we stand today. Like Colonel Rutley described to you, we are still trying to educate the customers on the process. We created a brochure. I have one here. It may not seem like a lot, but believe me it has done an awful lot to educate the customers on what the communications product group is all about. It

talks about IWSM tenets and organization and things like that.

We are working hard to create a seamless structure. We think the video teleconferencing will help. It has already helped immensely. We have quarterly meetings with the entire group to discuss where we are going. We are trying to standardize key areas such as contracting and configuration control.

WHERE WE STAND TODAY

- Still educating customers on the process
  - CPG brochure
- Working hard to create the seamless structure
  - Video teleconferencing will help
  - Quarterly meetings to discuss status
  - Trying to standardize key areas
    - » Configuration Control, Contracting
- Looking for more visibility and guidance on the financial management process

Lastly, I would say that we are looking for more visibility and guidance in terms of the financial management process and how that actually will be used in IWSM ultimately. We are on the road to creating a process for financial management, but I don't think we are there yet.

In summary, we believe that we are the "Patriots" for the deployed communicator. We've come a long way since we started to meet in that room a couple of years ago when we tried to decide where the center of gravity is. We think that IWSM is the right way to go and we think we are doing very well. Thank you very much.

Integrated Product Teams

Panel: **Major General (S) Robert F. Raggio**
F-22 Program Director
Mr. L. Gary Riley
Vice President & General Manager,
Lockheed F-22 Program

MAJ. GEN. (S) RAGGIO: We we are going to talk about something that we've been implementing now for three years in the F-22 SPO [Systems Program Office]. Gary and I are privileged to have inherited a program from giants like General Jim Fain [Lt. Gen. James A. Fain, Jr., Aeronautical Systems Center] and Mickey Blackwell who laid in a structure that is magnificent and is working well today. These people went to great lengths to change the culture and to establish a structure that is still working today.

There are a lot of people who are going to run over the same road. We did some things right, and there were some things that we could have done better. There are also pitfalls to watch on implementing IPTs. If you don't take them into account, you are really kidding yourself. That is what we'd like to concentrate on in this briefing. Gary and I will give it together because we frankly do everything else together.

MR. RILEY: Almost everything.

MAJ. GEN. (S) RAGGIO: I was going to say that sometimes our spouses think we spend more time with each other than we do with them.

Purpose Of F-22 Program

- Develop, Field, and Support the Next Generation Air Superiority Fighter Weapon System
- Establish the Standard For Acquisition Excellence

The purpose of the F-22 program is to develop, field, and support the next generation air superiority fighter. That has not changed and will not change. Secondly, the purpose of the program is to establish a standard of excellence for acquisition.

Today we will discuss the Integrated Product Development (IPD) philosophy; the organizational changes that were required for us in the government and on the contractor side; the implementation of metrics — without which I don't think IPD works; the lessons we've learned; and then we'll give a quick summary.

What Is IPD/IPY?

"Integrated Product Development Is A Philosophy That Systematically Employs A Teaming Of Functional Disciplines To Integrate And Concurrently Apply All Necessary Processes To Produce An Effective And Efficient Product That Satisfies Custome's Needs."

This is a good definition of IPD. I've seen a lot of them and this one really does capture its character very well. It comes from the Air Force Materiel Command IPD guide. It states it is a philosophy for bringing all of the different disciplines together. A very important point is that you do IPTs to affect IPD.

If your objective is not to do Integrated Product Development, and you just want to establish a bunch of IPTs, I think you are missing the point. The point is you want to do

integrated product development and you are doing integrated product development by the formulation of integrated product teams — which is no more than the right people with the right expertise, tools and dedication. That's what constitutes an IPT.

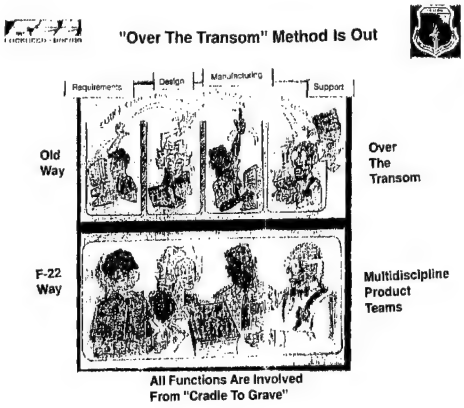
The Bottom Line Is. . .

IDP IS NOT ABOUT CHANGING *WHAT* YOU DO

ITS ABOUT CHANGING HOW YOU DO IT!

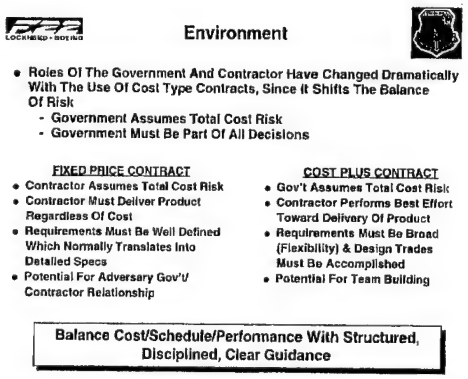
The bottom line is it is not changing what we do, but changing how we do it. It doesn't make program management any easier. We still have the challenges. We still have the every day battles. We still have all of the same constraints. It makes the product better.

MR. RILEY: I just want to make one little interruption. When General Raggio talks about change, one of the things that we have learned is that IPTs are not all that new to industry or to the Air Force. We've been doing them on a much smaller scale for many years. In the black world, it is almost forced upon you. You didn't call it IPTs. You called it compartmented programs. We discovered during that experience if you can get everybody working together, up front, that changes which are inevitable get accomplished much earlier in the program phase. The earlier you capture the changes, the cheaper they are to incorporate.



In the past we used to define the concept, hand it off over the transom to the designers, then over the fence to the manufacturing branch, and ultimately down to the support side. We'd find changes that were required to meet each one of those disciplines became more and more costly over time. Thus, the earlier you catch a change and the sooner you incorporate it, the less costly that change is going to be.

The problem, of course, is that it costs much more, up front, to bring those multi-discipline teams together. What we've now done is shorten the time span necessary and mashed them together. When we are able to incorporate changes, minimize them, and make the changes early in a program, the cost impacts to the program are much less.



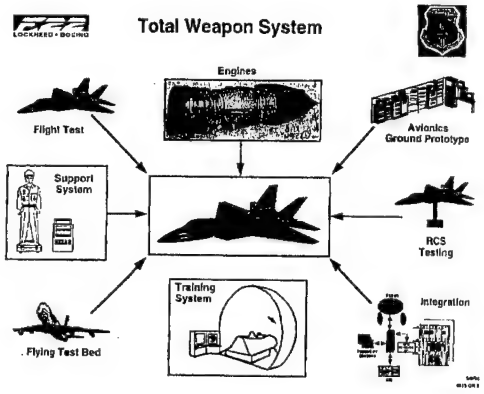
MAJ. GEN. (S) RAGGIO: As we go through this discussion on F-22 IPTs, it is important to note that a lot of the philosophy is applicable to other programs. However, every individual program has to tailor IPD and IPT for themselves. You can't take the F-22 approach and use it in a cookie cutter fashion.

A big change in the environment on F-22 is the contract type. This is a cost plus contract. This is the old fixed priced contract and these are the things we dealt with under fixed price. There definitely was a potential for adversarial government contracting relationships. Under a cost plus contract arrangement, there is a tremendous environment for team building. There is only one pot of money. And, every dollar spent by the contractor comes out of that one pot. He will do whatever you want him to do and it all comes out of that one pot. So this is really teaming because the pot doesn't get refilled.

MR. RILEY: Our portion of the contract is about $11 billion and covers everything but the engine. We have a supplier base that is nation-wide.

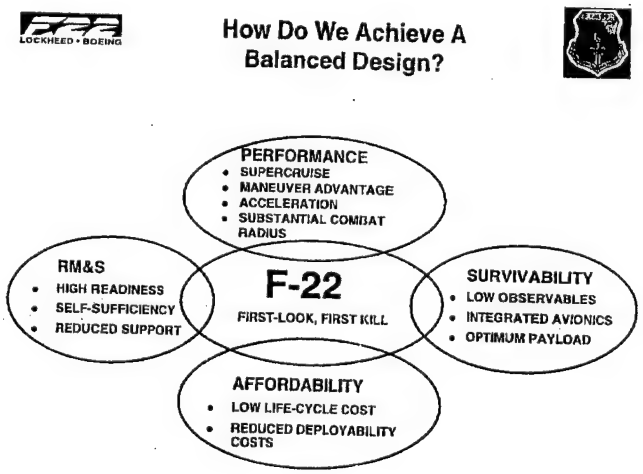
We talk about the diversity of the cultures of the program. When we sit down and compare notes concerning the cultural changes within the Air Force and the cultural changes within the industrial community, the changes are very similar.

We found if you don't have the support of top management, the implementation of an IPT and IPD concept isn't going to happen. We brought together on the contractor team, not only the three major contractors — General Dynamics (now Lockheed Fort Worth), Boeing and Lockheed — but also over 1,100 major suppliers throughout the country. We have found that without changes to the management styles within each of those companies, from the CEO on down, then implementation of the IPT philosophy has been ineffective. We've had to make changes throughout the teams and throughout the supplier community to implement that philosophy. General Raggio has had the same experience in the Air Force community. There are those who are believers and there are naysayers out there. Dr. Panzarella suggested that change must be cultural for it to be effective and long lasting, but the cultural change has to really start at the top. Lip service doesn't cut it in this environment.

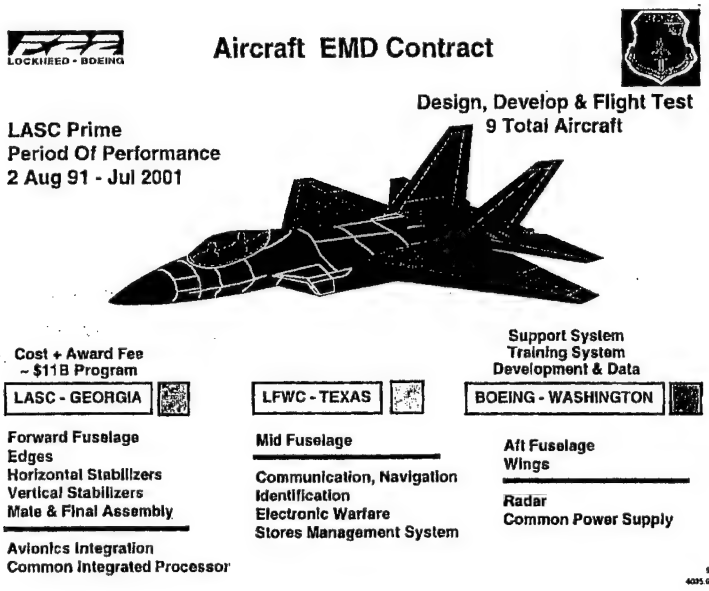


MAJ. GEN. (S) RAGGIO: Another thing that is different about the F-22 is that we are talking about a total weapons system — the air frame, engine, support systems, training systems, and all of the other stuff that feeds into those. Right away you start seeing the formulation of four different IPTs — separate and distinct.

The engine is really a subsystem of the airframe, but it is a separate contract with Pratt and Whitney. My other teammate, Walt Bylciw is sitting right out there in the audience and could be right up on the stage giving the same talk in the same place with Gary Riley and me because the relationship between Pratt and Whitney and the SPO and the relationship between Lockheed and the SPO are exactly the same. In fact, the cooperation between Lockheed and Pratt and Whitney in the F-22 program is something that is unprecedented.



This is what makes IPTs the most valuable, but it's one tough thing to do on a daily basis. When you are shooting for performance, survivability, affordability and maintainability, it is really tough to reach the optimum balance. If you don't have people from all of those disciplines on the IPT, you are not going to get a balanced design. We have a cardinal rule on the IPTs. If anyone walks away from a session on an IPT saying, "I've got every thing I wanted," then you probably don't have a balanced design. That discipline probably got more than it should have gotten because everybody should leave the IPT team with, "I had to give up something to get the balanced design."



MR. RILEY: Lockheed Aeronautical Systems company is the prime contractor on the F-22 program. The relationships we have with our sister company in Fort Worth (formerly General Dynamics) and with Boeing, are those of teammates not as subcontractors. In working with the three teammates, we have to continually reinforce that we are in this as a team and not as a prime-subcontractor relationship.

We have nine flying aircraft that we are building. Two of them are two place. We are also building two ground test articles, a static and fatigue.

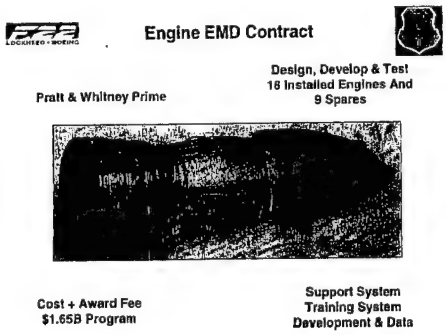
When the program was initially set up, it was three major corporations — Lockheed, General Dynamics, and Boeing — trying to divide the airplane up into thirds. We were trying to ensure that we each had an equal third of the manufacture and design.

Lockheed-Marietta is manufacturing the forebody, the edges, and the empennages. Lockheed-Fort Worth manufactures the midbody. Boeing is manufacturing the wings and afterbody.

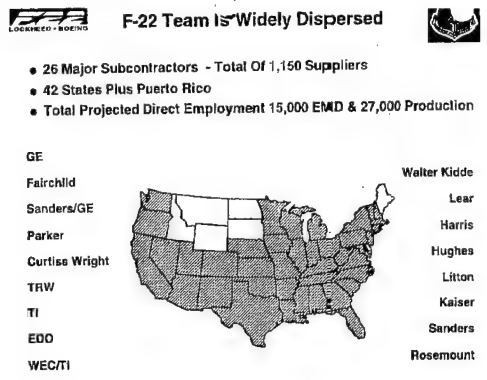
A tremendous amount of integration has been required across the three companies. I believe without IPTs, we wouldn't be able to implement the kind of rapid changes in the corporations and the rapid transmittal of data between the three companies as well as we are.

We have several IPTs which are made up of members from all three companies. We'll have an IPT leader who has a group — say in armament — who has people working for him from all three companies. They will spend time at their home company and they will spend time in a co-located facility. The members of the IPT do not think of themselves as working for Boeing, Lockheed-Fort Worth or Lockheed-Marietta. They work for the armament IPT.

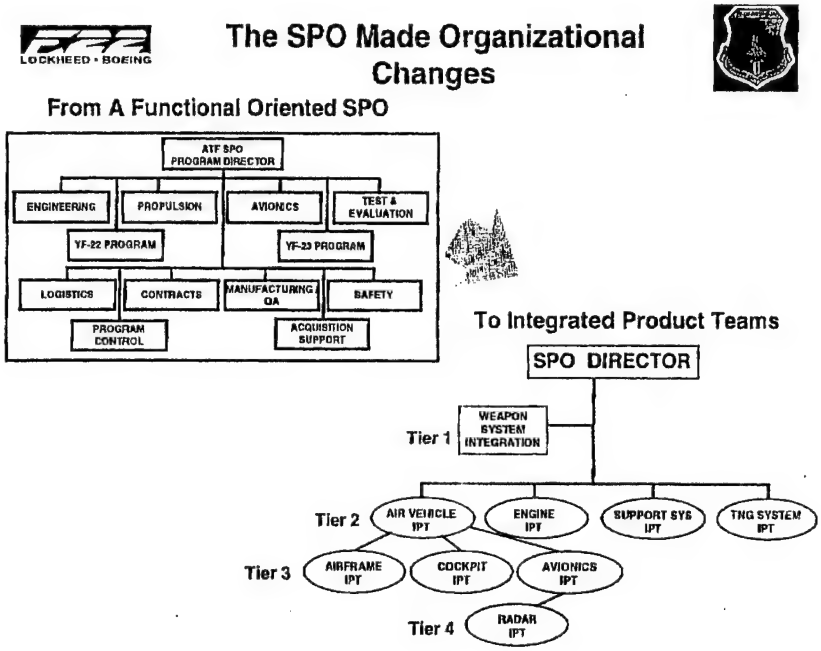
MAJ. GEN. (S) RAGGIO: I would say that this is a double-edged sword. It would be a lot simpler to have one contractor in one location doing F-22. But I wouldn't want to have to pick just one of our present contractors because each of them bring individual strengths to the program. I think we've capitalized on those individual strengths. However, the fact is that having three companies in three places increases the integration effort.



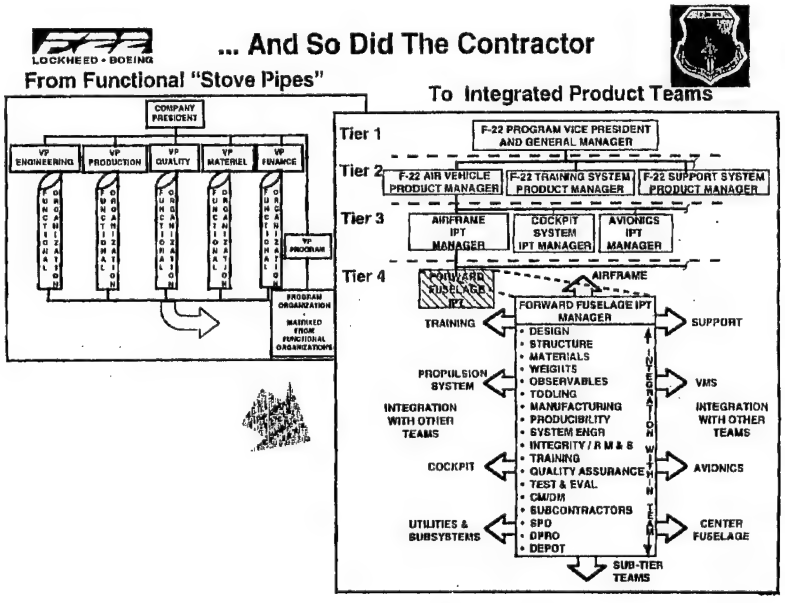
The engine development effort is a little more straightforward. Walt Bylciw runs the engine program out of Pratt and Whitney as the prime contractor. It is a cost plus award fee program worth $1.65 billion. Included within the contract are also the support systems, training systems, and development and data.



As Gary said, we are talking to 26 major sub contractors and a total of1,150 suppliers in 42 states and the Commonwealth of Puerto Rico. There are 15,000 jobs in EMD and another 27,000 projected in production. We couldn't have pulled all that together without the IPD environment.



The SPO made organizational changes from how we were structured in the demonstration/validation (dem/val) phase to how we're are organized now. Instead of having the breakdown by functional disciplines common to other SPOs, we have a weapons system integration group that consists of the functional leads that tier down.



MR. RILEY: In the past, our company was organized with "stovepipes." We had strong functional organizations that provided resources to each one of the lines of business that we had — tactical aircraft, airlift and maritime patrol aircraft. What we've done for the F-22 program is to create the IPT structure.

In our forward fuselage IPT that is worked in Marietta, we have a team made up of individuals from design, structures, materials, manufacturing, tooling, etc. Every one of the representatives of these functional branches that make up the IPT is co-located. They provide the expertise that is necessary to make sure we cover every piece of the airplane during its development. Representatives from the SPO, DPRO, logistics and training organizations are also members of our IPTs. Also included are the suppliers. We have people also out of the supplier community that are co-located in almost all our IPTs.

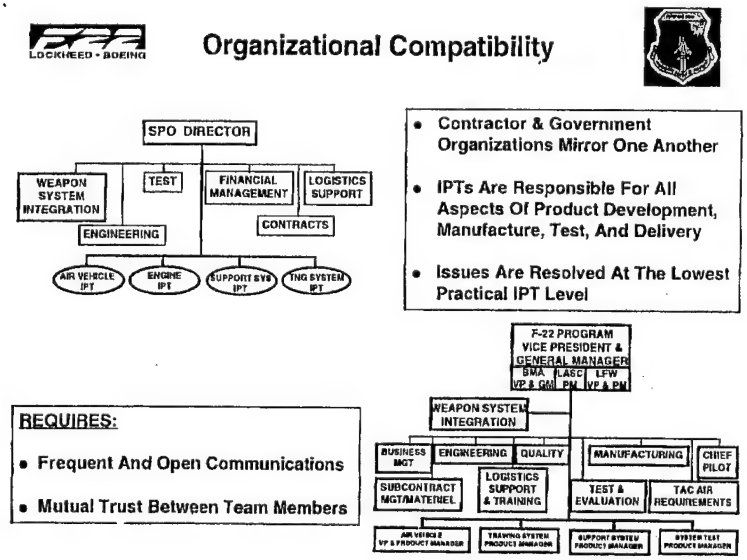
To assure the integration of the team's efforts, we have "Analysis and Integration" IPTs that function in a systems engineering capacity at each and all IPT levels. At the tier-two level, all IPTs report to one of four product managers: Air Vehicle, Support Systems, Training Systems and Systems Test. The product manager is accountable for product completion — design through manufacture.

MAJ. GEN. (S) RAGGIO: We are trying to blur the lines of who an individual is employed by. We want them to identify with being a member of their IPT.

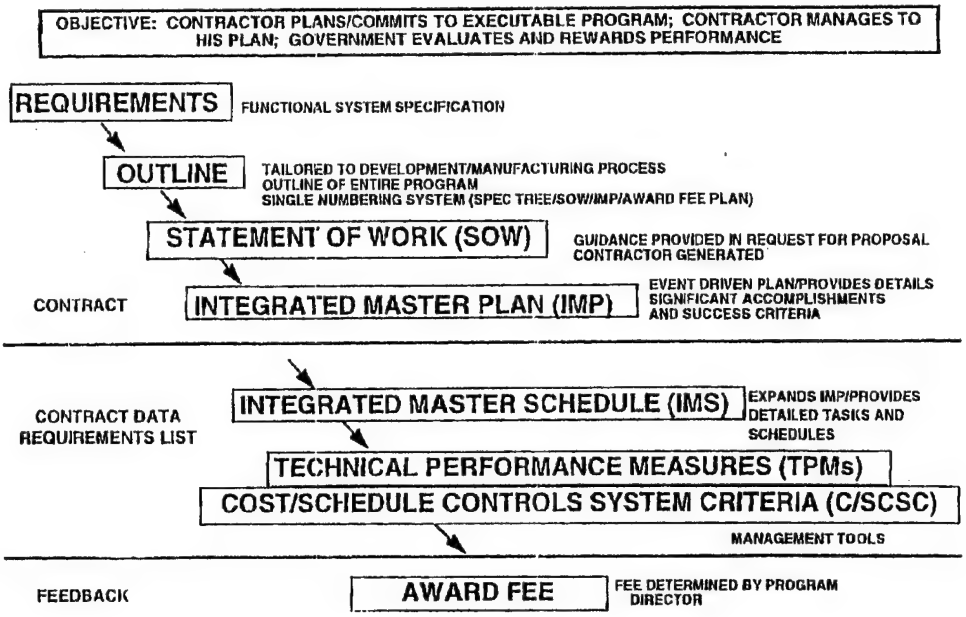
This is very important. The DPRO at every location is a part of the IPT — part and parcel of the every day operation of the IPT. Also, on the SPO side, you have an exact replica of the company at each tier. Everybody has a counterpart. Issues can be resolved at the lowest level possible. It builds trust and if the trust is not there, you can see it right away. You really can.

MR. RILEY: Before you go on Bob, you mentioned our tier-two leaders (product managers) representing the three companies. Two are Boeing employees, one from Fort Worth and the other Marietta. Reporting to me are three program managers, one at each company. They are accountable for the performance of their piece of the program for their respective company.

MAJ. GEN. (S) RAGGIO: If I had to pick one key point on the success of IPTs and the F-22, it is that the organizational structure of the IPTs matches the work breakdown structure, or the work breakdown structure was built into the IPTs. The funding flows through the IPTs. Statements of work are generated by the contractor, an RFP, request for proposal, is generated and developed into an Integrated Master Plan (IMP). These are the things that make up a contract.



Integrated Management Structure



IPT Management Tools

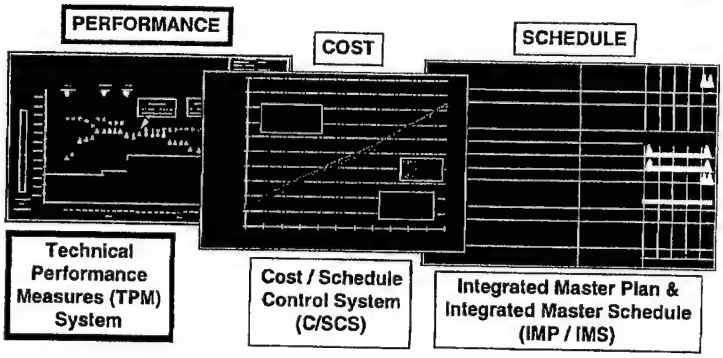
- Every Individual/Team Has A Tool Set
- Tool Set Begins With Identification Of A WBS Item (e.g., 1000 - Air Vehicle, 1500 - Vehicle Management System)
- Tool Set Includes:

- SOW Task - IMP Section - Specification Paragraph - Budget	PLAN AND COMMIT
- Technical Performance Measures - C/SCSC - IMS Section	TRACK
- Award Fee	MOTIVATE

Every IPT manager, every person on every team, has the same IPT management tool set.

It begins with his work break down structure (WBS). The tool set includes his statement of work (SOW), his integrated master plan (IMP) section, his specification paragraph and his budget. That is what he uses to plan and commit. He uses technical performance measures (TPM), cost/schedule controls system criteria (C/SCSC), and his section of the integrated master schedule (IMS) to track his task accomplishment. Motivation is provided through the award fee. That is the profit line for the company.

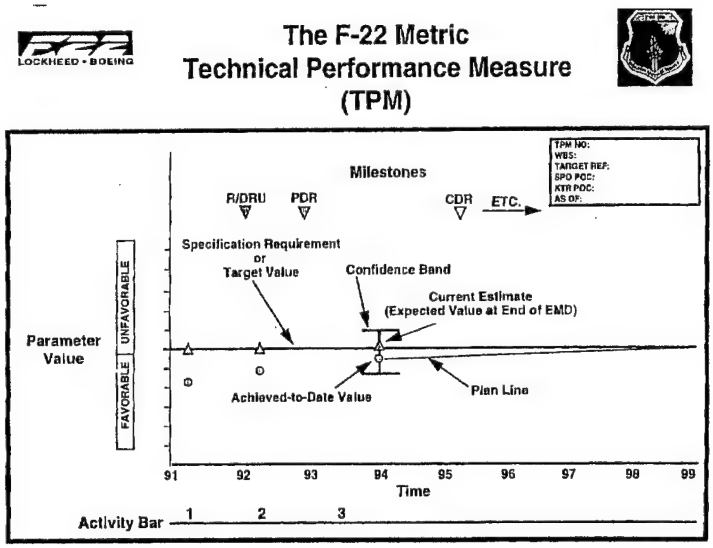
Implementation Metrics



Now we'll talk to each of these areas, performance, cost and schedule. This is where we are implementing the metrics, without which this system does not work.

Let me speak to one of our favorite tools here — technical performance measures (TPM). This is really the F-22 metric. We've

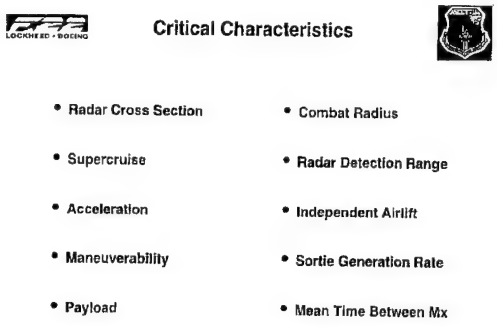
got this same format for all of the metrics in the program, including the ones for production of the engine at Pratt and Whitney.



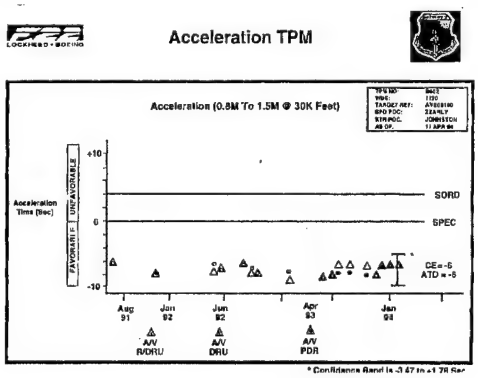
What is important about the metrics is that the SPO counterpart is identified, the contractor counterpart is identified by name, and the rose is pinned upon that person's chest. He is responsible for knowing what is in that metric and what affects that metric.

Also identified in the metric are the milestones and target goals, what has been achieved to date at any time in the program and what is projected at completion.

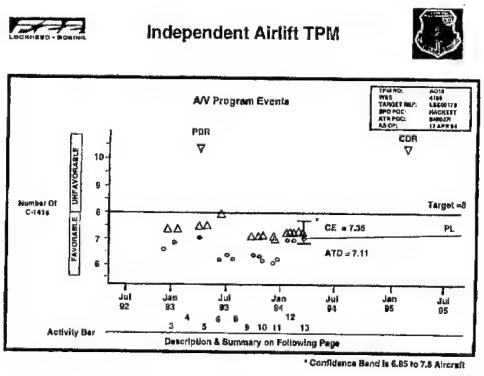
There is an interesting story behind why it was named a "technical performance measure." The first ones that were really integrated completely in the IPTs were the engineers and the managers. In retrospect, that was probably the easiest one. I'd say we're about 90 percent done there. The next one is much tougher — the business end — integrating that on to the IPTs. We're still not completely there yet, we're still working on that. In integrating the engineers, we found that one of the cultural barriers was that an engineer paid attention to technical things. That was their legacy. So, we called them all technical performance measurements (TPM) to encourage the engineers to pay attention to them, whether it was technical or not.



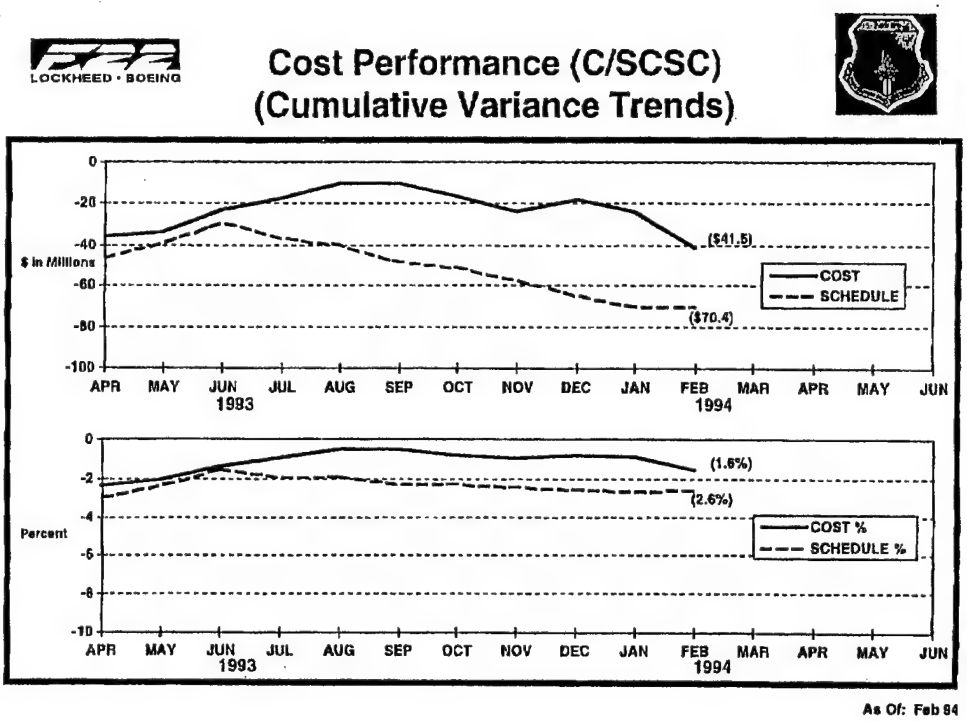
I think we've done a marvelous job of solidifying the requirements with our user. There are ten characteristics that are in the acquisition program baseline — radar cross section, supercruise, acceleration, maneuverability, payload, combat radius, radar detection range, independent airlift, sortie generation rates, and mean-time-between-maintenance. Each of these have a TPM.



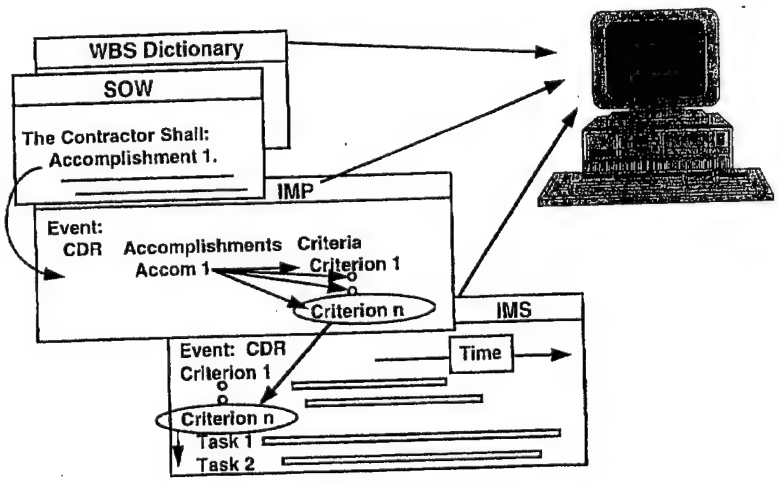
For example, you could pull up the TPM on acceleration conditions and identify the zero-point, the data we are tracking and a confidence band for the final data.



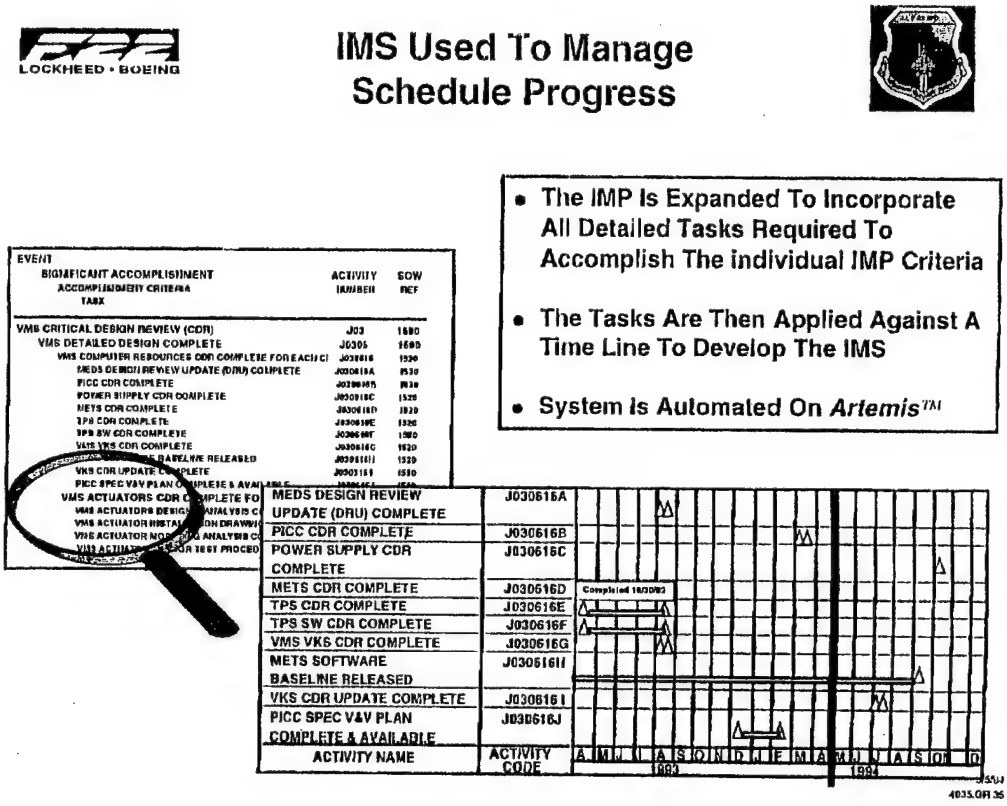
This next example is less technical but tracks independent airlift. Under certain conditions, to deploy, we must carry all the gear for the F-22 on eight C-141s. When the "loggies" started putting more stuff on the plane, we started to bounce over the line. By tracking this data, our review spotted the trend and we said if it doesn't fit on eight C-141s, they are not taking it. When you use the measurements in your reviews, the system works.

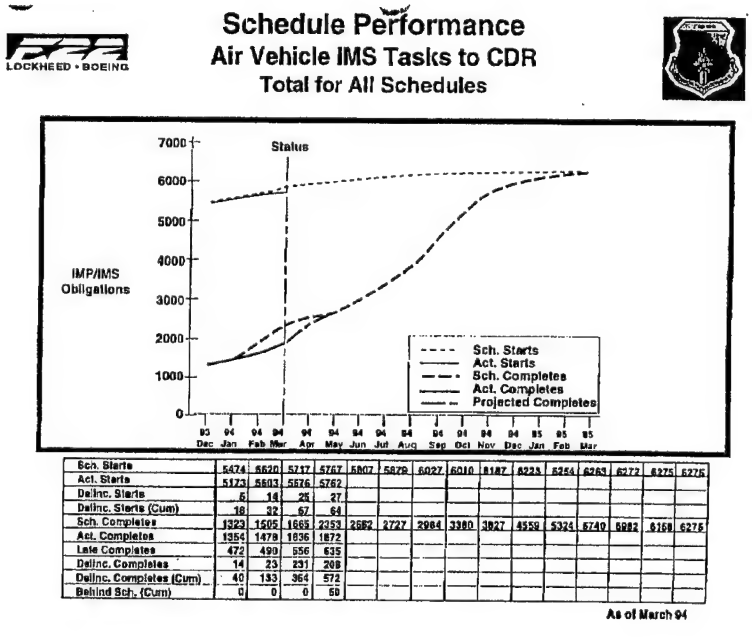


MR. RILEY: We use similar metrics for cost. We measure both cost and schedule as a percent of performance. We are correctly tracking within 2 percent of cost. All of our TPMs are reviewed regularly and action plans reviewed as appropriate at our program management reviews. We're doing quite well from the standpoint of overall cost performance, but we continue to track ourselves very hard.



MAJ. GEN. (S) RAGGIO: And, then the last area is the schedule, our integrated Master Plan (IMP) and Integrated Master Schedule (IMS), and how those two work together. Essentially, the statement of work states the contractor shall accomplish certain requirements.





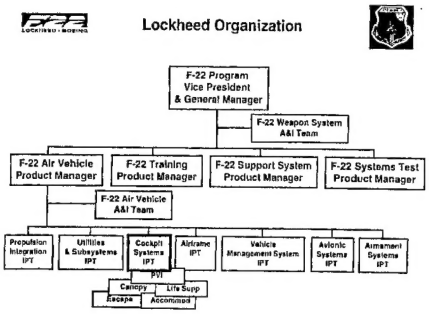
Sch. Starts	5474	5620	5717	5767	5807	5879	6027	6010	8187	8225	6254	6269	6272	6275	6275
Act. Starts	5173	5603	5676	5762											
Delinc. Starts	5	14	25	27											
Delinc. Starts (Cum)	18	32	57	84											
Sch. Completes	1323	1505	1665	2353	2582	2727	2984	3380	3927	4559	5325	6740	6982	6159	6276
Act. Completes	1354	1479	1636	1872											
Late Completes	472	490	556	635											
Delinc. Completes	14	23	231	208											
Delinc. Completes (Cum)	40	133	364	572											
Behind Sch. (Cum)	0	0	0	59											

As of March 94

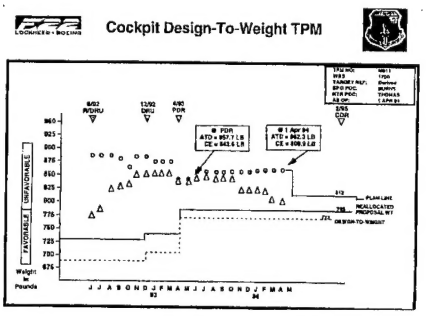
Those requirements become part of an event. For example, one event may involve a critical design review (CDR). For each required accomplishment in the statement of work, we have established criteria and a schedule of tasks. This becomes the Integrated Master Schedule.

Anybody on our computer network can pull up an event and review the performance criteria, tasks, and milestones. All this is on a data base called "Artemis."

When I go into a review and ask how many tasks have been closed, how many have been opened, how many should have been opened, and how many should have been closed, and I'm able to get the answers.



MR. RILEY: Now, we will move from the generalities of what we do to a specific example using the actual charts to measure the cockpit system IPT. This is a tier-three IPT.

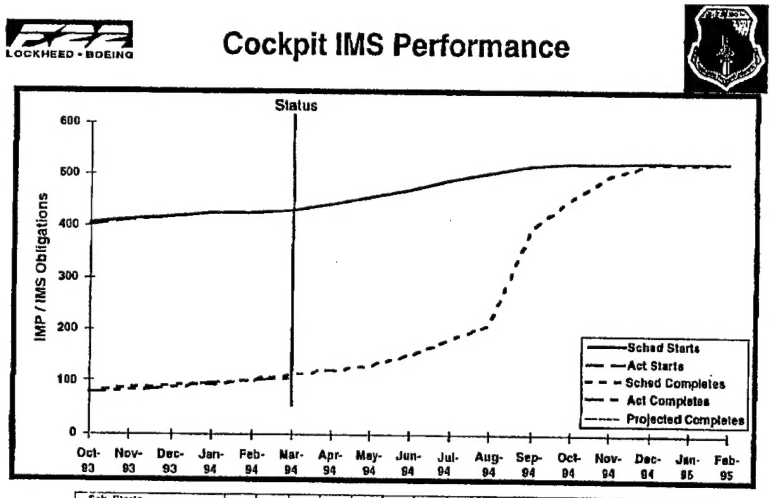


One of our performance TPMs that gets an awful lot of publicity is weight. As we have progressed in the development of the aircraft, the weight has risen. We have a plan of how to accomplish weight improvements with a view toward returning to the proposal weight.

For example, Kevin Burns in the SPO and Ken Thomas at Lockheed share the responsibility for monitoring this TPM for the cockpit IPT. Costs have also increased in the cockpit design area and we are working to reduce those costs.

MAJ. GEN. (S) RAGGIO: In the last decade, costs, schedule and performance date fell into disrepute because the data was always 90 days late and nobody paid attention to it. General Fain demanded in the contract that the bidders give him firm financial data 30 days after end of month close out. He also demanded that they give him flash data, first look data, five days after close out. Everybody said that's impossible. I'm telling you, it is not impossible; it is being done today. Flash data is not good data, it has a lot of mistakes in it, but once the IPTs look at it and confirm the mistakes, the data that is in at 30 days is good, hard financial data.

MR. RILEY: That was not an easy task when you consider that the majority of all IPTs have to incorporate their supplier cost data as well. One of the hardest hurdles to get over is making sure you have current supplier data. It now takes us about three weeks to get complete cost data available bettering the 30 days required in the contract.



Sch. Starts	400	413	416	423	420	436	440	464	470	487	503	515	520	521	522
Act. Starts	401	411	416	423	425	426									
Delinc. Starts	0	0	0	0	1	0									
Delinc. Starts (Cum)	1	1	1	1	2	2									
Sch. Completes	87	85	80	82	102	111	121	139	161	182	209	280	483	497	520
Act. Completes	74	81	87	95	100	106									
Late Completes	38	39	42	42	48	48									
Delinc. Completes	0	0	0	0	1	6									
Delinc. Completes (Cum)	0	0	0	0	1	7									
Behind Schedule (Cum)	0	0	0	0	0	4									

As of Mar 94

For example, we are tracking performace for the Cockpit IMS. There is still an evolution of the process as we work the IPTs and the TPMs associated with them. For some activities, we didn't have a good handle on the status. We have now expanded the measure to include a look at how we are tracking all the work that is taking place. For the Cockpit IMS, we have 323 items in work and we use the "Artemis" system to check on what is ahead or behind schedule and then assess the impact.

Award Fee Process

- Award Fee Is A Motivational Tool
- F-22 Contractors Selected Based On Their Plan To Deliver A Weapon System On Schedule, On Budget, That Meets Specifications
- F-22 Award Fee Process Is Outlined In Award Fee Plan
  - Each Period Culminates With An Award Fee Decision By The Fee Determining Official Based On A Recommendation From The Award Fee Review Board
- The F-22 Award Fee Process Is A Win-Win Proposition

F-22 Lessons Learned

- IPT Training Is Essential At All Levels
- The Idea Is To Employ IPTs To Accomplish Integrated Product Development
- IPT Philosophy Takes Leadership Commitment from the Top on the Part of Both Government and Contractor
- Management Cultural Changes Do Not Occur Overnight
  - Functionals Tend To Flock !
- IPTs Must Have Experienced And Empowered Members
- The "I" In IPT Can Easily Become "Independent" Vice "Integrated"
- Integration Across The IPTs At Every Level Is Absolutely Imperative

MAJ. GEN. (S) RAGGIO: What you just went through was a program review of the cockpit IPT. That is how we take all of the reviews on all of the IPTs. Gary and I take the reviews at the tier-three IPT level. We spend a lot of time looking at tasks where we're behind. We hold a lot of detailed discussion on those areas and focus in right away on each team because it team is a little sub-SPO. Each team operates in their own decision space and their own reporting. Now, the big trick is to integrate that.

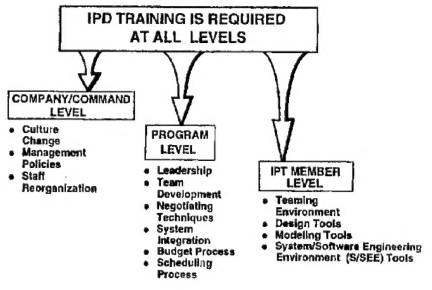
We used to integrate functions in the old projects office in the SPO. Today we are integrating products across IPTs. You still have to do that integration, otherwise that becomes an independent product team and not an integrated product team.

In the end we have the award fee, and here's the philosophy of award fee on F-22. It is a cost plus contract. The contractor states right in the statement of work what he will perform — cost, schedule, and performance. He built the triangle to stay in. In staying in the triangle, he has the opportunity to earn 100 percent of the award fee. It is not for work "extra and above" the contract.

We don't want any extra and above work done. We want exactly what was promised. That will earn 100 percent of the award fee. It is a win-win situation.

Let's get to the lessons learned. This is the most important part. Don't ever underestimate the amount of training that is necessary to implement IPTs. By training, I mean training at the company and command level. If you don't have a culture change within the leadership — from the CEO leadership down — forget it. The policies have to be changed. The staff has to be reorganized and that commitment is not simple to get at the top. It is a lot simpler to get lip service than it is to get real action. Believe me, the CEOs of Boeing, Lockheed and Pratt and Whitney have bought in at the CEO level, I am convinced.

F-22 Lessons Learned (Cont'd)



At the program level it is equally important. It becomes important at each of the IPTs. We have sent each of our IPTs in the last two years to an individual conference away from the normal workplace. We have to do that periodically just to keep it going because the natural state is to fall back into the way we've always done it.

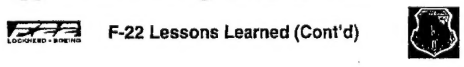
As I've said, the idea is to employ IPTs to accomplish integrated product development, not just to do IPTs. IPD must be the end game.

Functional leadership must be handled with care. If not explained properly, you are going to have all of your key functional people go into a defensive crouch because they think it is the end of their existence. Nothing could be further than the truth. Nothing. IPTs require more functional involvement, not less.

The functional responsibility becomes one of ensuring that each of those IPTs have the right people on it. We have found that not everybody is right for an IPT team and, believe me, not everybody is made up to run an IPT team. When you've got the wrong person there, you've got to have the ability to put the right person in. IPTs must have experienced people — very experienced people. They have to stand alone and unafraid out there, so they have to be experienced and they have to be empowered. It is also easy to become independent rather than integrated. You have to watch that.

We've found that at every level — tier-one, tier-two, tier-three, tier-four — we had to establish an integration team. An analysis and integration team was needed to keep the level integrated. Without it, we had problems.

MR. RILEY: Let me just add some experiences we had when we first selected the IPT leaders. Basically, we took the lead engineer in each discipline and made them the IPT leader. That was unfortunate in a few cases, not only for the team, but also for the individuals themselves. Not all good engineers make good IPT leaders. We have made changes where we now have manufacturing people leading an IPT in the design phase because they turned out to be the best leaders. It is an integrated team and, remember, we have manufacturing on that team along with support and training assets as well.



- IPT Managers Must Have Authority Over Personnel And Budget Resources
- An Integrated Network Of Communications Software Tools Is Mandatory
- Physical Collocation Of Core IPTs Is Essential And Collocation Of Dispersed Teams Is Required On A Periodic Basis
- Set Team Goals and Objectives - And Track Them!
  - Ensure All Team Members Participate In Decisions
  - Develop Meaningful Team Metrics

One of the hardest things to do is to get people to give up budget authority. The IPT leader has the total budget authority not only for the functional branch that he was selected from. Getting over that hurdle was a major accomplishment.

The three companies came to this contract with different and distinct ways of doing business and we had to establish a common architecture for all systems across all three companies. That caused each of the companies to change the way they did business on the F-22 program. The biggest change is in the software tools themselves. We are completely integrated. We are real time. There are work stations talking to work stations, just as if they were right next door to one another.

It also helps if the IPTs can be co-located. Each company has specific areas of responsibility. For example, the hydraulics team is located in Fort Worth, but they have members in Seattle and Marietta. To make the IPT cohesive, they communicate. We use video teleconferencing five and a half days a week for about 12 hours a day. We also bring those teams together at least once a month, if not more often, to meet in one location and go over common issues.

Finally, team goals and objectives have to be set and tracked. It is always hard to go out and get somebody to set goals and objectives, but once they are down and monitored it makes the job easier to do.

- Understand Who All Your Customers Are
  - Active Customer Involvement Is Essential
  - Traditional Roles Must Change
- Put The Right People In The Right Job At The Right Time
  - Appoint And Train "Leaders"
  - Replace "Leaders" That Don't/Can't Lead
- Commit to Continuous Improvement

"Understanding your customers" is an issue that has really been an educational process for us. It takes the ability to set up and frankly discuss issues. It's fun to watch new people come on the program. We bring people on from the Air Force and from industry, and you find out that they initially collapse back

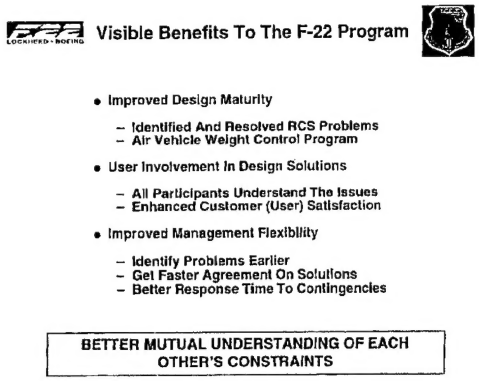
into their functional shells. We just recently had an experience in Fort Worth where we did what we would call our initial dry run of a roll up of an EAC with Air Force participation. It was a shambles. For the new people on the program from the Air Force, the first time they saw it, they questioned what was going on. And, rightfully so. They had never been a participant in a contractor's initial dry run before.

Getting the right people on the right job at the right time is tremendously important. We still struggle with making organizational changes, but the sooner you nip it in the bud, the better off we are.

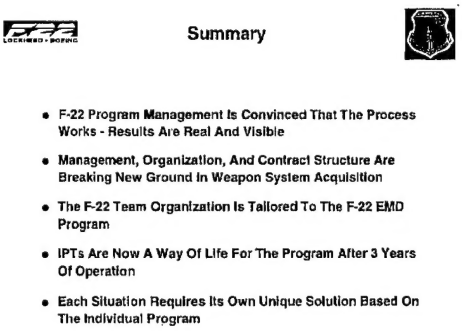
MAJ. GEN. (S) RAGGIO: You can't do that one without functional support. You need functionals helping you out to select the right people. If you find the same thing that we found, first you think the engineering management is a challenge. Then you keep going and say, no, the bigger challenge is the financial community — bringing them completely in on the IPT team.

MR. RILEY: There are so many stories that go along with what we've done with people and how they've changed their perspective. We have a business manager who was the Vice President of Finance at Marietta who is now the team business manager. We would fight endlessly to get the finance organizations to let go and play in the IPT process. He is now one of the strongest advocates that we have toward IPT involvement — pulling away from the functional finance core and getting out to the IPTs. Finance is probably the last stronghold because it is the company's bread and butter.

Committing to continuous improvement is important. The groundwork was laid by General Fain and Sherm Mullen in establishing the IPT concept and the way we've employed it on F-22 program. It has been tremendous and Bob and I have had the opportunity to really do the refinement that goes with it. There is going to be a continuous need for refinement, and we're still working on it and making mistakes everyday. But we are able to make corrections, get them turned around and learn from each and everyone.



MAJ. GEN. (S) RAGGIO: I think there have been visible benefits in the F-22 program. I caution again that you can't take everything we have done and directly apply it to your situation. If you are different in any way, shape or form, you've got to tailor this stuff to your program.



In summary, I don't think we can go back on F-22 now. It has been in being three years in the SPO and I don't think people could operate any other way. I think the same thing is true at Lockheed. For a long while, the F-22 program was an anomaly. Then the programs in ASD changed over to IPT — B-2 changed over to IPT and the training systems SPO began using IPTs.

Each situation requires its own variation on the IPT system. I've presented what, from our perspective, is the way to go for us. We are happy with the way it is running right now in F-22. I guess it is time now for questions.